THE AEROPLANE and ASTRONAUTICS

OCTOBER 9, 1959

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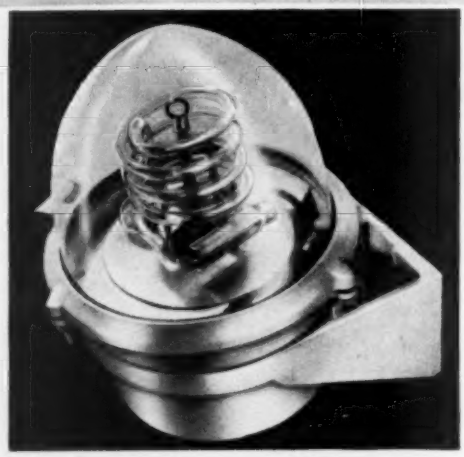

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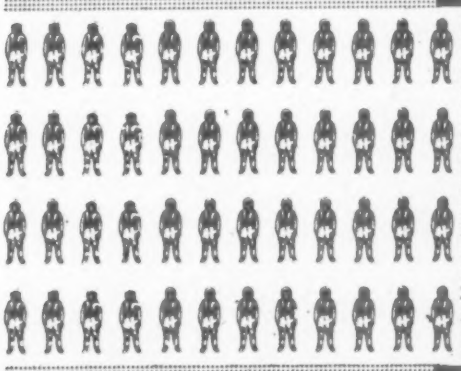

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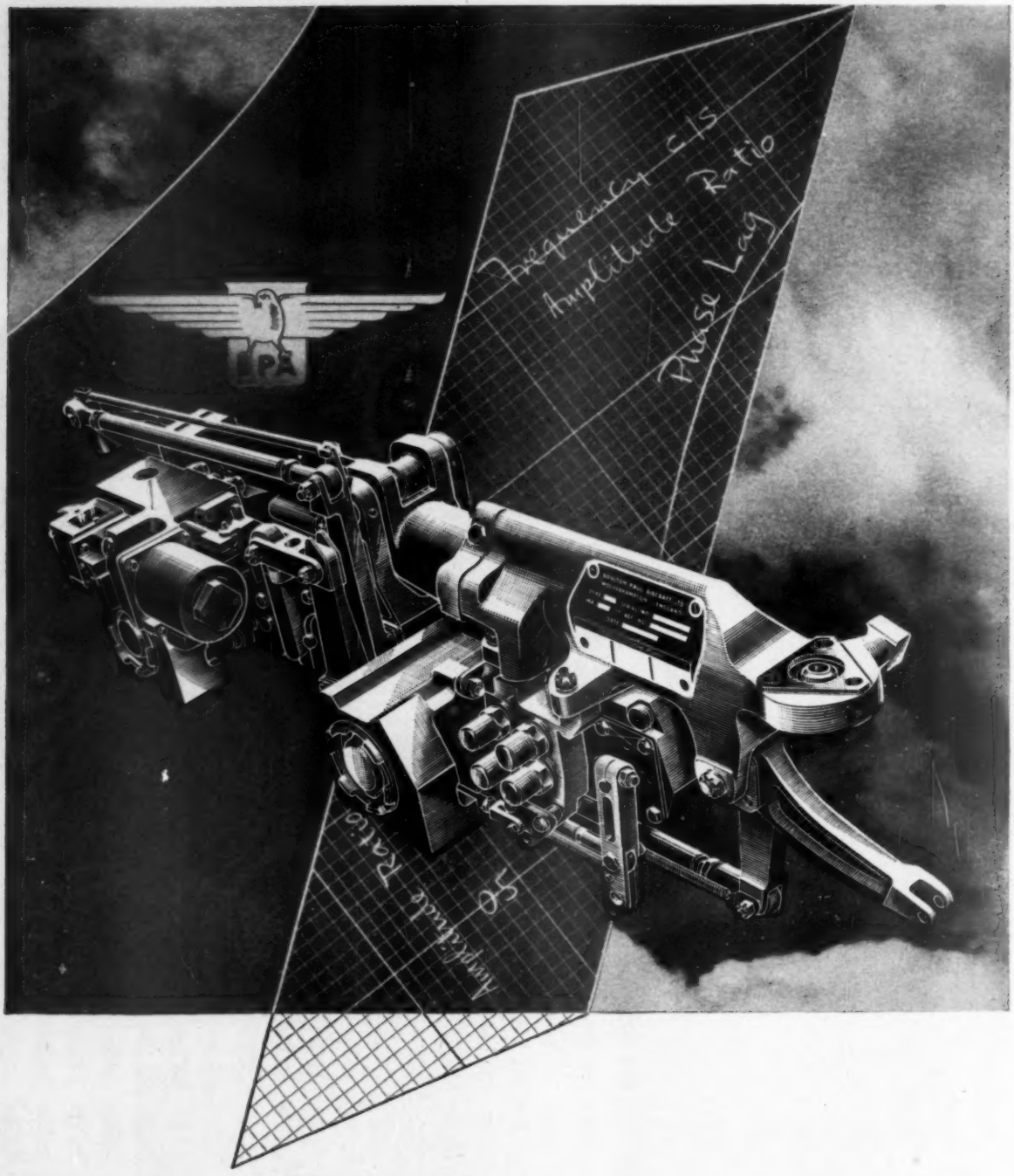

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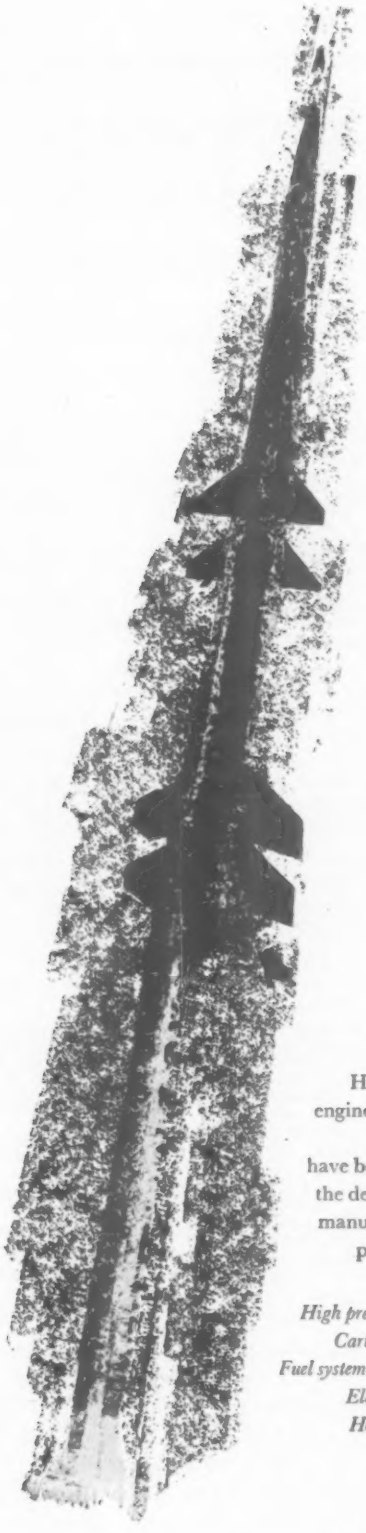

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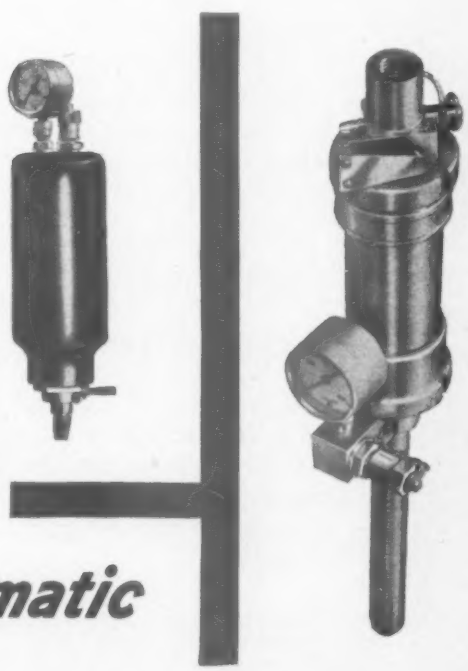

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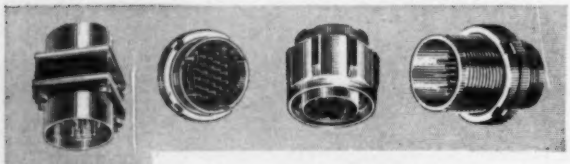

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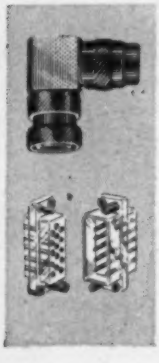

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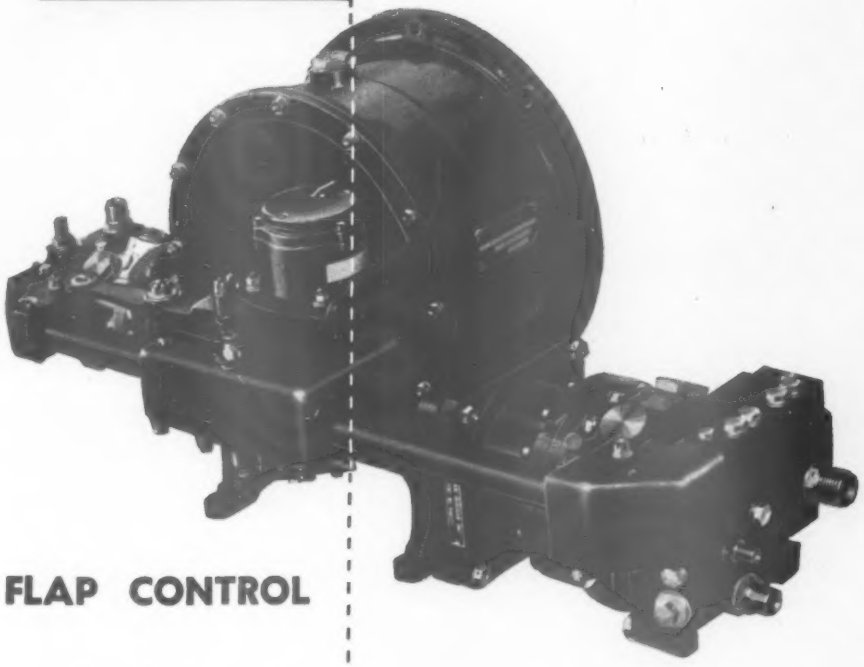

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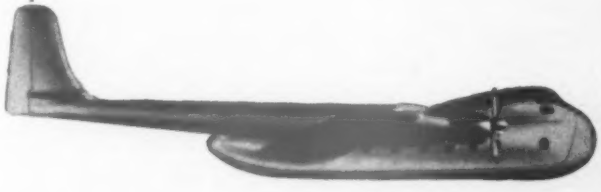

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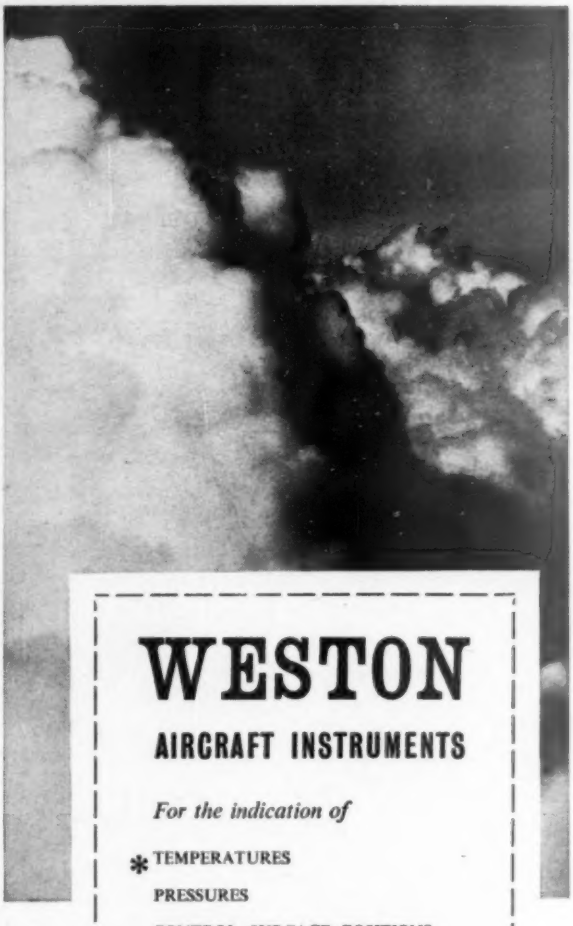

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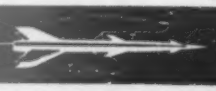

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Forty years ago a party of flying instructors from the Royal Air Force School of Special Flying at Gosport left for the United States to demonstrate the revolutionary methods of teaching the Art of Flying devised by the late Colonel Smith-Barry.

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THE AEROPLANE and ASTRONAUTICS

VOLUME 97 . NUMBER 2503 OCTOBER 9, 1959

Leadership and Single-mindedness

A splendid tribute to three outstanding British aeronautical engineers was to have been made in the United States on October 7 by the presentation of the Elmer A. Sperry Award for 1959 to the de Havilland Aircraft Co., Ltd., for the vision, courage, and skills displayed in conceiving, developing and producing the World's first jet-powered passenger transport aircraft. The Award, which was to be given at a dinner in New York during the joint R.Ae.S.-I.A.S. Conference, is made to Sir Geoffrey de Havilland as president and inspired leader of the company bearing his name, to Mr. C. C. Walker, the company's then technical director and chief engineer, and in memoriam to the late Major Frank B. Halford, then chairman and technical director of the de Havilland Engine Co., Ltd.

Sponsored by the four U.S. engineering bodies in which the late Elmer A. Sperry was most active, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Society of Automotive Engineers and the Society of Naval Architects and Marine Engineers, the purpose of the Award is to encourage progress in engineering of transportation.

Making an address on behalf of the recipients, Sir Aubrey Burke, chairman and managing director of the de Havilland Aircraft Co., Ltd., traced the origin of the Comet back to 1943. He concluded with memorable words: "We are often told that the Comet must be the most thoroughly tested aeroplane in the World, and this we believe. However, this is not an end in itself. The achievement of the three men, honoured by the Award, was that they visualized in the middle of war a new conception of travel in peace, and to have led their project through some astonishing vicissitudes with a determination which is now yielding its dual reward—a fine practical airliner coming and going easily and regularly from airports large and small all over the World, and a design team rich in experience. These men are already immersed in the problems of the second and third generation of jet airliners and their future successes will rest to a great extent on the leadership, foresight and single-mindedness of de Havilland, Walker and Halford."

Accepted in Spite of Ourselves

Sometimes brains get used in spite of their owners. OSTIV is the international body which co-ordinates the scientific and technical aspects of sailplaning. Some time ago this body set out to produce airworthiness requirements for the 15-metre Standard Class Sailplane and decided to use British requirements as a basis. However, the British Gliding Association would not agree to take part in the job. A good reason for their non-co-operation was that an international requirement tends to include the most stringent cases of all the nations involved—which could make the result useless.

However, ten other nations thought it worthwhile to tackle the job and recently in Paris a third draft was evolved. As it is said to be usable, this country may yet find itself accepting it in spite of the fact that there was no "official" British participation. In this non-insular age surely more might have been achieved and our ideas better applied had there been official British participation.

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Matters of Moment

Lunik III's "Boomerang" Orbit

RIGHT on cue, on the second anniversary of the launching of Sputnik I, the World's first artificial satellite, on October 4, the Russians successfully fired a third rocket to the Moon, this time on a path apparently designed to carry it around our natural satellite and back to the neighbourhood of the Earth.

Described by Soviet scientists as an "automatic interplanetary station," the 613-lb. instrument container, which detached from the final stage, carries research instruments, a television device for photographing the unseen face of the Moon, and two radio transmitters operating on frequencies of 39.986 and 183.6 megacycles. Transmitting power is supplied by solar batteries and conventional chemical batteries, data being apparently tape stored and relayed back to Earth during periods of two to four hours each day. The instruments include those for measuring "radioactive radiation, temperature, and magnetic forces."

The *Tass* news agency stated that a radio link would be used "to control the elements of the orbit," presumably to reduce the speed of the instrument container in the vicinity of the Moon so that lunar gravity can effectively swing the vehicle around the body at the stated distance of about 6,250 miles from the surface and return it in the general direction of the Earth. In this case, the instrument container would embody a retro-rocket. The detached instrument container is accompanied by the empty final stage rocket weighing about 1½ tons.

At the time of going to press, the ultimate fate of Lunik III cannot be predicted with any certainty, but it appears that, if all continues well, the vehicle will become an Earth satellite on a stretched orbit which the Moon may intercept once every lunar month. On the other hand, it has been suggested that the probe may swing back to the Earth and pass it to become a satellite of the Sun; or alternatively it could intercept the Earth's atmosphere and burn up.

The vehicle appears to be following one of the trajectories favoured by the Soviet mathematician V. A. Egorov. He reported before the 1957 I.A.F. Congress in Barcelona that hundreds of Moon-flight trajectories had been computed in Russia between 1953 and 1955 in which the possibility of circum-lunar flight with return to Earth, the question of hitting the Moon, and also the particularly important question of the effect of dispersion on the initial trajectory for both cases, were all considered in detail.

A trajectory of particular interest, one circumnavigating the Moon, with return deliberately intercepting the Earth's atmosphere for recovery purposes, it was considered, could only be made with mid-course control on the return path. Thus, in addition to establishing artificial satellites around the Moon as "lunar laboratories," and possibly soft-landing instruments directly on the Moon's surface, the "boomerang" flight-path allowing for the recovery of a capsule may well be a future Soviet objective on the road to manned lunar flight.

TROPHY AWARD.—Mr. H. M. Woodhams (second from right), president of the A.W.A. Flying Group, receives the Masefield Trophy—awarded annually to the most efficient Group. Presenting the Trophy is Mr. H. Best Devereux; on the left is Mr. J. Nicholls, chairman of the A.W.A. Group, and on the right Mr. D. O'Clarey, the secretary.

NA.39s in Quantity

A PRODUCTION order for NA.39 low-level strike aircraft has been placed by the Ministry of Supply with Blackburn Aircraft, Ltd. It covers a substantial number of NA.39s for the Royal Navy in addition to the 20 development aircraft now being produced; deliveries will be spread over several years.

It will be recalled that in September last year the Ministry of Defence placed orders for jigs and tools and long-dated materials for the first batch of NA.39s for the Fleet Air Arm. At that time it was reported unofficially that 50 aircraft were to be ordered in addition to the development batch of 20.

The NA.39 made its first flight on April 30 last year and seven aircraft are now flying on development tests. This fast production of development aircraft augurs well for a rapid

NAVAL STRIKER.—As recorded elsewhere on this page an order for the Blackburn NA.39 low-level strike aircraft has now been placed by the M.o.S. The NA.39 has two Gyron Juniors.

Photograph copyright "The Aeroplane and Astronautics"

CARIBOU CLOSE-UP.—A new study of the D.H. Canada Caribou—which under the designation YAC-1 is to be used by the U.S. Army; three were to be handed over on October 8. The powerplants are Pratt & Whitney R 2000s.

service debut; Mr. Eric Turner, the Blackburn chairman and managing director, said last year that the type would enter service in 1961. Already trials with the aircraft have been made at Malta and deck-landing trials on H.M.S. " Victorious " are imminent.

Designed for high-speed under-the-radar attacks, the NA.39 has two de Havilland Gyron Junior engines each giving 7,000 lb. thrust. A distinctive feature of the aircraft is its area-ruled shape which has been adopted to delay the drag rise and to give good controllability at high speeds. Blown flaps and air-blowing over wing and tailplane leading-edges are used to give the NA.39 good control characteristics at the low speeds which are needed for operation from carriers. Ferranti radar equipment is being produced for this strike aircraft.

A Lightning Escape

IN our post-Farnborough review of survival equipment we wrote: " Although the introduction of the Mach 2 Lightning has greatly increased the speed range over which pilot escape facilities must be effective, little change in existing ejection-seat design has so far been necessary." The truth of this was dramatically demonstrated last week by the spectacular escape from a disabled Lightning by English Electric's chief production test pilot Mr. J. W. C. Squier, at a speed which must have been well over M=1.5.

The ejection took place in the region of 40,000 ft., so that the indicated airspeed, which is the critical factor so far as wind blast is concerned, was probably rather more than the 550 knots I.A.S. of earlier emergency escapes with Martin-Baker seats. It is a striking testimony to the design of the seat, which brought the pilot down with no ejection injuries at all, and to the fortitude of Johnny Squier that he was able to drift ashore in his dinghy 30 hours after his escape, when hope for his survival had been abandoned.

The aircraft involved was the prototype Lightning T.4 two-seat trainer, XL 628, which was being flown solo at an advanced stage of its flight testing, from Warton, on October 1. Radar contact with the aircraft was lost when it was off St. Bees Head, Cumberland, and eye-witnesses reported seeing the Lightning dive almost vertically into the sea. Visibility at the time was bad, and no sign had been observed of a parachute.

No details have been revealed of the reason for ejection, but it is apparent that the Martin-Baker Mk. 4BS automatic-ejection seat functioned perfectly when fired. The Mk. 4BS seat, which was shown at the recent S.B.A.C. display, has several new features, including an improved combined harness, personal equipment connector, electric seat-raising mechanism, strengthened seat-pan and revised glass-fibre dinghy pack, the last-mentioned proving particularly important in this case.

After ejection, with interlinked canopy jettison, the pilot remained in the seat, which was stabilized with two drogues, in free fall for about three minutes. At about 10,000 ft., the barometric control automatically initiated seat separation and parachute release, after which the pilot was free to lower his dinghy pack on its 30 ft. lanyard to swing beneath him and relieve him of its weight on touching the water first.

He spent most of the day trying to paddle in, while two R.A.F. Shackletons from Kinloss, a helicopter from Acklington, U.S.A.F. Grumman SA-16 amphibians and an R.A.F. launch from Holyhead searched for him. He saw an aircraft and fired a flare when it was overhead, but it failed to see him. He eventually grounded on some rocks at Garliestown, Wigtownshire, and stumbled ashore some 23 miles from the last radar plot of the P.11.

He was suffering from shock and exhaustion, but the only injuries resulting from his 40,000-ft. fall were earache and bloodshot eyes. It is interesting to note that on the only other ejection at a comparable speed (about 600 knots I.A.S.), from a Super Sabre at about 6,000 ft., the American pilot was very severely injured by wind blast.

Engine Export Statistics

AUGUST was a record month for British aero-engine exports, which totalled £6,145,819. Comparable figures for 1958, 1957 and 1956 were £4m., £3.3m. and £2.3m. Since the War engine exports have earned just over £260 million—more than half of this since January, 1957.

The installation of British engines in foreign aircraft suggests that engine exports may not fall as rapidly as exports of aircraft will probably do in the years ahead. At present British engines are used in no fewer than 55 foreign types of aircraft. The industry has been particularly successful with its civil turbine engines; these power 61% of the gas-turbine airliners which have been delivered or are on order. Rolls-Royce has led in this field and its Conway is scheduled for 34 Boeing 707s and Douglas DC-8s.

Three-cornered Bombing Contest

FOR the first time this year, the annual Bomber Command Bombing and Navigation Competition was a three-cornered contest between Victor, Vulcan and Valiant crews. Finishing on September 30, the 1959 Competition was purely a Bomber Command affair with no competitors from the U.S.A.F. Strategic Air Command, whose 92nd Bombardment Wing operating B-52s won the combined bombing and navigation trophy in 1958.

All three squadron awards—the Laurence Minot Trophy for the highest marks in the overall contest, the Armament Officers' Trophy for the best bombing results, and the Sir Philip Sassoon Trophy for the best overall navigation results—have been won by No. 617 Squadron (Wg. Cdr. D. Bower, O.B.E., A.F.C.) operating Avro Vulcan B.1s. Another Vulcan squadron—No. 83—came top in the individual crew awards for the best bombing and navigation performance and for the best navigation.

A Vickers Valiant crew of No. 7 Squadron won the individual bombing award.

Matters of Moment . . . .

Steel for The Bristol 188

ALTHOUGH it has been known for some time that Bristol Aircraft, Ltd., were building an all-steel aircraft for supersonic research, its security grading has made it impossible to say much about its structure and the materials used for it. However, in a recent feature on the British steel industry, the London *Evening Standard* revealed that one of the high-strength materials employed for the Bristol 188 was a stainless steel made by Firth Vickers and designated F.V.520.

According to the manufacturers, the maximum service temperature of this steel is 500° C.; this is equivalent to the ram temperature rise during flight at about Mach 3.4 in the stratosphere. Other features of this 60-ton steel is its high strength and fatigue resistance and its excellent resistance to corrosion.

F.V. 520 can be heat-treated to give a high tensile strength and, unlike many stainless steels, it can readily be welded. It can be supplied in the form of sheet, strip coils, bars and castings. Strip coils can be produced up to 1 metre wide in 16-28 gauge. The largest sheets available are 10 ft. x 4 ft.; they can be produced in gauges 14-16.

It would seem likely that this material is also used in the structure of de Havilland's Blue Steel LRBM. Much the same general heat and strength requirements would be expected for a high supersonic aircraft and a ballistic missile.

The pressurized tank structure of the Atlas ICBM is constructed by welding stainless steel sheet and a similar technique may well be used for Blue Streak.

Full Time to Hovercraft

NEWS that Marconi's Wireless Telegraph Co., Ltd., have agreed to second Mr. L. A. Sweny, manager of their aeronautical division, to Hovercraft Development, Ltd., of which he is a director, as from October 1 last means that he will relinquish his managerial duties with Marconi's though remaining available for consultant duties in aeronautical business. In Mr. Sweny's own words this means a break with aviation electronics with which he has been associated for the greater part of his life. He thus devotes his energies to the new field of air cushion transportation after 43 years in aviation of which 23 have been spent as manager of Marconi's aeronautical division.

It was flying in H.12 flying-boats, Short, Fairey and Wright seaplanes during World War I that convinced him that aviation could not exist without radio. Marconi's had appreciated that since 1911, when they were flying spark transmitters in a Howard Flanders biplane. Indeed there seems to have been corporate activity devoted to aviation radio in the company since 1914.

The aeronautical division in its present form has existed since 1920. Mr. Sweny became the fourth of its managers in 1937. Before that he had supplemented his wartime experience as a communications engineer (1919) with the first British air transport company, later joining the Signals Branch of the Department of Civil Aviation of the Air Ministry. He was promoted to be in charge of the U.K. Civil Aviation Signals Organisation in 1934. Two years later he joined Marconi's.

Mr. L. A. Sweny, who has been seconded by Marconi to Hovercraft Development Ltd.—of which company he is a director.

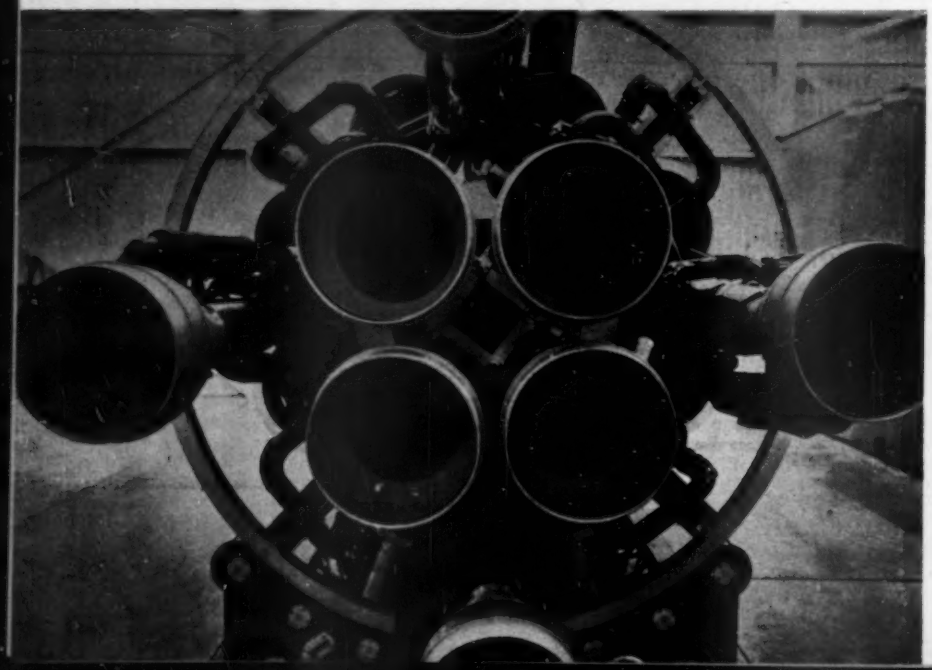
In 1942 Mr. Sweny rejoined the Fleet Air Arm. Two years later as a Commander R.N.V.R., he became Assistant Director of Communications Development (Naval) with the Ministry of Aircraft Production. He returned to the Marconi Company in 1946.

He is an Honorary Freeman of the City of London, a Liveryman of the Honourable Company of Coachmakers and Coach Harness Makers and a Freeman of the Guild of Air Pilots and Air Navigators, so he is likely to retain his aeronautical connections in the new field of transportation to which he is now going. He will take with him the good wishes of a host of friends.

Avro Fire

DAMAGE estimated at more than £1 million was caused by a fire at the Avro Chadderton Factory on October 3. Most of the damage was in the administrative block where a section of roof measuring about 200 ft. by 400 ft. collapsed on top of works offices where estimating, progressing and job-card work was done. Part of the drawing-office was also damaged, but the drawings library and master drawings were saved, although some were soaked by water. The fire was brought under control just short of the assembly shop for Vulcan 2s and the Avro 748 transport. The machine shop, tool room and production lines were not affected, but materials which were lost included several tons of magnesium and titanium.

According to Sir Roy Dobson delivery schedules will not be affected; structural repairs to the factory should take about two months. Clearly the loss of production records and the inevitable dislocation caused by the fire will demand an intensive effort if Vulcan deliveries are to remain unaffected and the first flight of the Avro 748—scheduled for next February—is not to be delayed.



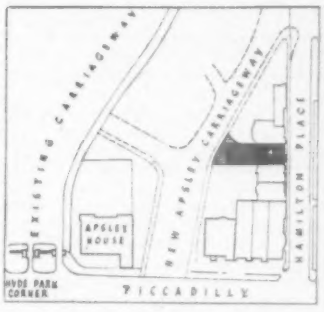
BIG CLUSTER.—America's hopes of restoring the balance with Russia in space-development depends on the Saturn 1.5-million-lb.-s.t. eight-engine booster, shown here in model form. Originally under development by the Army Ballistic Missile Agency at Huntsville, the project is now being taken over by the U.S. Air Force.

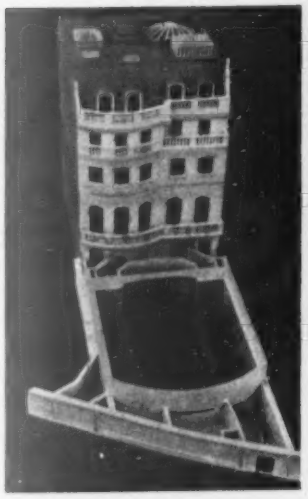
R.Ae.S. Lecture Hall—Work Begins

NEWS that work began last Monday on the lecture theatre for the Royal Aeronautical Society at 4 Hamilton Place, W.1, has a special significance, not only because of the money still needed to pay for the undertaking, but because of the act of faith involved. Last May the Society opened an appeal for money to build this new lecture hall; about £10,000 has already been received in actual donations; this with promises of support and covenants brings the total to about £90,000 spread over seven to 10 years.

The fund thus falls £60,000 short of the £150,000 originally estimated as the cost of the lecture hall with its furnishings and equipment. We understand that less than one-tenth of the membership has so far made any gesture of support; nevertheless as there remain some 9,000 members who have yet to make a contribution, the Council has only to persuade each of them to undertake to pay £1 a year for seven years to raise the sum. A fiver from each of these members right now might be a more satisfactory solution. Though the donor might soon forget a fiver, 9,000 of them would make a memorable total.

The lecture theatre now being built is to seat about 320 people. As can be seen from the model it will take the form of an extension behind the Society's existing headquarters in Hamilton Place. The contract for its construction has been awarded to Holland & Hannen & Cubitts, Ltd. The work will be completed by next October in time for the start of the autumn lecture session. As well as providing the lecture theatre which the Society has always lacked, this new hall will also be available for use by other aeronautical bodies.





Money is still needed for the R.Ae.S. lecture hall in London, which is to be sited between the back of 4 Hamilton Place and the new carriageway.

Construction of the hall has been made possible by work on the new Apsley carriageway which forms part of the reconstruction scheme for Hyde Park Corner. At any other time the cost of building on the site would have been prohibitive because materials could only be brought through the existing building from Hamilton Place to the site. And this explains why the work is being pushed on.

A Great Seaplane Engineer

SIR ARTHUR GOUGE, writing from Wootton House, Isle of Wight, has announced his retirement. Until the recent reorganization and acquisition of the company by Westland Aircraft, Ltd., he had been vice-chairman and chief executive of Saunders-Roe, Ltd., since he left Short Brothers in 1943.

Most of his working life in aviation, which began when he went as a mechanic to Rochester in 1915 at the age of 25, has been spent in the building and design and development of seaplanes, both float and boat. He was knighted in 1948, the year in which he delivered the 36th Wilbur Wright Memorial lecture. He was president of the Royal Aeronautical Society 1942-44, and of the S.B.A.C. in 1945. He was made a Freeman of the City of Rochester in 1937, the same year in which he received the British Gold Medal for Aeronautics. In 1939 he received the Musick Memorial Trophy. He is a M.I.Mech.E., Hon.F.R.Ae.S. and F.I.A.S. His career thus provides another example of a young man climbing from the lowest rung to the top of his profession.

In the days when he was working to fit himself for the high positions he ultimately held it was necessary to do study at the end of a hard day's work. Young people of today have little conception, in this country at any rate, of the single-mindedness and determination needed by those without private means to win a Bachelor of Science degree at the time Arthur Gouge did, following his studies at Gravesend Technical School and Woolwich Polytechnic.

Appointed chief designer by Mr. Oswald Short in 1926 and general manager in 1929, he was thus irrevocably associated with the great days at Rochester which saw the building of the famous Calcutta and Singapore flying-boats and, ultimately, the Empire flying-boats which introduced a new concept of aerodynamic cleanliness and consequent high-performance into the sea-going province of civil aviation. It is doubtful whether any aircraft has ever had more enthusiastic fans than the Empire boats.

His old friends, to whom he has addressed his thanks for their help and co-operation in the past, will wish him well in his retirement. It is significant that the seaplane, after some years of eclipse, is attracting fresh attention in the Western World. Perhaps Sir Arthur may yet see the Saro Princess fly again—this time with nuclear power.—T.J.

From Biplanes to Flying-boats

MR. H. E. BROADSMITH, who was connected with aviation both in England and Australia throughout almost all his working life, died in the Isle of Wight on Sept. 25 at the age of 69.

After receiving his engineering training at the Lancashire and Yorkshire Railway Locomotive Works, and serving as a marine engineer with the Furness Withy Line, Harry Edgar Broadsmith joined the firm of A. V. Roe and Co., Ltd., in 1912, and was eventually appointed works manager and chief engineer, thus being associated with the famous Avro 504, and in particular with the delivery and acceptance trials at Farnborough of the first 504s to be delivered to the R.F.C.

In 1919 he went to Sydney, Australia, as Avro's Australasian representative, where he formed the Australian Aircraft and Engineering Co., Ltd. This was Australia's first aircraft factory and the area of ground leased by him at Mascot, Sydney, for flying tests was the first step towards the modern airport.

Arising from his investigations on the suitability of Australian timbers for aircraft construction, his firm received a contract from the Commonwealth Govt. for the construction of Avro training machines for the Royal Australian Air Force. For his services to Australian aviation he was made an Honorary Life Member of the Royal Aero Club of New South Wales.

On his return to England he became one of the original directors of Saunders-Roe, Ltd., when he, together with Sir Alliott Verdon-Roe and Mr. John Lord, acquired a controlling interest in the firm of S. E. Saunders, Ltd., in 1928, and was appointed technical director and general manager. Early in 1929 the name of the firm was changed to Saunders-Roe, Ltd.

He was thus responsible for the production of a series of monoplane flying-boats, the first of which was the Cutty Sark, built and test flown in a record time. The R.A.F. Coastal Command adopted its successor, the Saro Cloud, for navigational training.

Mr. Broadsmith was appointed during the Second World War to organize facilities for the testing and modification of Catalina flying-boats. He was joint managing director of Saunders-Roe from 1939 until he resigned to take up practice as an aviation consultant in 1945, returning to Australia in 1948.

He was a member of the S.B.A.C. council 1938-43.

A Pioneer of Aviation

WE regret to record the death in France last week of René Caudron—one of his country's pioneer aeronautical engineers. He was 75 years of age.

With his brother Gaston, René Caudron started his aeronautical career with the design of a horse-drawn glider, but the first real essay by the two brothers into powered flight came in 1909 when they built a monoplane powered by a 25 h.p. Anzani. Later they designed an amphibian which made its début at Monaco and after that they produced a biplane which was built in large numbers during the War years that followed.

In March, 1914, Réné Caudron, already with a reputation as a daring pilot, had given a further demonstration of his ability by taking-off from an improvised platform on the deck of the French cruiser "Foudre." The following year Gaston Caudron died leaving Réné in control of the business.

In the early days the two brothers had started a school of aviation at Crotoy and it is not surprising that training aircraft were a speciality of the Caudron company after the War. And for many years the company René Caudron had helped to found was among the leading names in French aviation.

Air Transport

Convair Order Changed

AS a result of a thorough investigation of their route requirements, Swissair have decided to purchase Convair 600s in place of the Convair 880 Model 31s ordered a year ago. The size of the order has been increased from five to seven, of which two will be leased by Swissair to S.A.S. for four years.

Swissair will use its Convair 600s on routes to the Middle and Far East and to South America, starting in the summer of 1961. The first of these aircraft, which have been given the name Coronado by Swissair, is scheduled to fly in September, 1960, and three aircraft will be used in the certification programme to obtain F.A.A. type approval in May, 1961.

The Convair 600 is a logical extension of the original 880 Model 22, taking advantage of the extra power and better economy of the 16,100-lb. s.t. General Electric CJ-805-23 turbofan engines. It is unique among contemporary commercial transports in having anti-shock bodies on the wings—an application of the area-rule principle developed by Dr. R. T. Whitcomb to slow down the flow ahead of the shock-wave and reduce basic separation.

The first order for Convair 600s, announced in July, 1958, was for 25, from American Airlines. Since then, the gross weight has increased by 1,000 lb. to 239,200 lb. The latest data from Convair show that the Coronado has a cruising speed of 496 knots at 35,000 ft. at 175,000 lb., and a maximum range (without fuel reserves) of 4,740 naut. miles carrying a 25,120-lb. payload. Maximum coach-class accommodation is for 134, but the Swissair announcement speaks of a mixed arrangement for 28 first or de luxe class seats and 59 tourists and a S.A.S. statement refers to mixed-class layouts for up to 96 passengers.

More Traffic for B.O.A.C.

FIGURES given by Mr. Basil Smallpeice at London Airport last week show encouraging improvements in B.O.A.C.'s North Atlantic and other traffic. During the first six months of this financial year there has been a 40% increase in passenger traffic. U.S. dollar earnings from all North Atlantic traffic were up by 32% during the period, with a 12-month revenue of $33 million (£12m.). On a World-wide basis B.O.A.C.'s passenger traffic increased by 27%.

Mr. Smallpeice said that these improvements, and certainly those on the Atlantic, were largely due to the introduction of the Comet 4. Whereas Eastern route traffic had increased by 22% during the first six months of the current financial year, that for the African routes, on which the Comet was not yet operating, had risen by only 2%.

Some 73% of the Comet services from London to New York and Montreal—the more difficult, one-stop westerly operations—had arrived within 15 minutes of the scheduled time and 89% within 60 minutes. These figures were substantially better than any recorded with other types of aircraft on the routes. On the North Atlantic service there had been no case of engine failure and only one shut-down following the failure of a fuel control unit.

The Comet 4 had, on all routes, carried 76,000 passengers, flown 6,377,000 miles, for a total of 269,770,000 passenger-miles in 15,150 revenue flying hours during its first 12 months of service since October 4, 1958, when it started flying on the North Atlantic routes and April 1, when the four-times-weekly Tokyo services were introduced. Operations over the London-Johannesburg route, via Rome, Khartoum and Nairobi, will be started on December 2; other Comet introduction dates already announced are November 4 to Australia, and January 25, 1960, to South America.

Supersonic Sophistications

SUPERSONIC transports for service in the 1970s are likely to have "a third master pilot in the cockpit, with an infallible memory and instantaneous reflexes," according to Mr. R. C. Sebold, Convair's vice-president, engineering. This master mind—a member neither of the pilots' nor of the flight engineers' association—will be a computer which will continuously monitor the performance of the aircraft's vital systems. In its capacity of "a kind of electronic worrier," or an ever-present doctor, it will detect trouble the instant it occurs and prescribe corrective measures which could be taken immediately, performed at the next landing, or postponed until the next scheduled overhaul. It will also be singularly introspective and able to detect—and prescribe for—its own "illnesses."

Nearing completion at Renton, and due for roll-out later this month, the first Boeing 720 medium-haul transport, smallest member of the Boeing jet family. To carry 90-150 passengers, the 720 has a false leading edge on the inner wing to reduce the t/c ratio, and full-span leading edge flaps. Engines are lightweight JT3C-7s of 12,000-lb. thrust, but the 720B in 1961 will have 17,000-lb. JT3D-1 turbofans.

Other delights are promised the supersonic traveller by Mr. Sebold. There will be, for instance, individual television screens, with fingertip controls at each seat, which will be able to pick up regular commercial transmissions and will also be linked to closed circuits in the aircraft which will give a wide-angle vertical view downwards, or a view over the pilot's shoulder. No windows will be provided, because sun-glare would be painful at 60,000-80,000-ft. cruising altitudes and because window cut-outs would reduce the structural integrity of the pressure cabin.

To compensate for the operationally desirable steep angles of climb and descent, passenger seats could be pivoted to be always upright, and would be locked in position for cruising flight.

The picture Mr. Sebold paints is perhaps not very encouraging to those who wish to see air transportation placed on a sound commercial basis before a new round of re-equipment buying develops. As Mr. Sebold said, the "cost of developing supersonic transports will be immense . . . government support of the development cost may be necessary." He claimed an "important World-wide propaganda impact for the first Mach 3 transport." An even greater impact might be obtained from the development of a safe, simple-to-operate air bus which will bring flying within reach of the great proportion of the World's population which still pays for its travelling out of its own rather shallow pockets.

Rational Short-haul Transport?

LAST week's announcement of winter vehicle-ferry fare reductions by Silver City was accompanied, at the associated Press conference, by information that negotiations were in progress for the design and manufacture of a short-haul transport to this airline's specification.

The fare cuts, averaging from 13% to 33% according to route and type of vehicle, are being made in an effort to build up off-season traffic and follow a year's operations during which a record number of cars have been carried on the various services. This number—67,435 as at midnight on September 30—was at least 7,000 more than the figure on which the 1958-59 fare structure was likely to have been based, and compares with 50,006 for the previous (October-September) financial year. The fares will remain in effect until May 31, 1960.

From the viewpoint of the operator of an essentially seasonal series of services, the important effect is probably that average aircraft utilizations have risen to something over 1,000 hr. per annum and that the total fleet can thus be considered to be in fairly economic use throughout the year. Hence the proposed extensions, already announced, into medium-haul vehicle-ferry operations for which approvals are still awaited.

The only firm items of information so far available about the proposed short-haul transport are that a decision should be reached before the end of the year; that it will be to Silver City's own specification; that it will be a Franco-British venture; and that it will be available for vehicle-ferry and other operations in 1962.

It may be assumed that the design will be for an aircraft

Air Transport . . . .

which is effectively capable of maximum use both for vehicle-ferry and/or passenger work over stages up to say, 500 miles. For short-haul work high cruising speeds are not of particular time-saving importance and a figure of 200 m.p.h. might be adequate. The required capacity could be for a maximum of about 100 passengers, or, perhaps, five/six cars and up to 40 passengers.

The explanation of the "Franco-British" nature of the project might be that a variant of the Rolls-Royce Dart-powered Hurel Dubois 37 (see our issue of September 11, p. 158) is being considered and that this variant will be built by a Franco-British company. Another possibility is a Bristol-Bréguet project.

The political advantages of the purchase of such a Franco-British aircraft are also understandable. The expanding future of Silver City's Silver Arrow rail-air-rail services, at least, is tied up with developments at Le Touquet and of the proposed railway spur there, and these services are flown in co-operation with a non-operating French company, Cie. Air transport.

Seattle—Tokyo—Seattle

AS briefly recorded in last week's issue (p. 294), one of B.O.A.C.'s Boeing 707-436s made a first (and fast) non-stop flight from Seattle to Tokyo on September 27; this Conway-engined 707 was undergoing its F.A.A. functional reliability tests.

Official distance and time figures for the outward journey became available after our issue had gone to press. The distance of 4,815 st. miles was completed in a time of 10 hr. 55 min. and at a block speed of 441 m.p.h. Average head-winds of 85 m.p.h. were experienced and for 60 minutes of the flight the 707 was in a 207 m.p.h. jet stream; fuel for about 90 minutes flying remained in the tanks after landing and the aircraft was step-climbed to an end-of-cruise altitude of 40,000 ft.

The take-off weight was 302,000 lb. and among the 57 technicians and others on board was Mr. Grant McConachie, president of Canadian Pacific Airlines, and representatives of B.O.A.C. The return flight was made via Honolulu on September 29-30.

Ideals in Terminal Design

WITH the appearance of a second edition* of the guidance document produced by its technical secretariat, IATA has further consolidated and brought up to date the airlines' views on the best ways of laying out airport terminal buildings and aprons. This book provides a combination and extension of the information in two earlier manuals—its first edition of July, 1956, and the supplement ("Apron Requirements for Turbine-powered Aircraft") of January, 1958.

*"Airport Buildings and Aprons." International Air Transport Association, Terminal Centre Building, Montreal 3, P.Q., Canada.

The Association makes it very clear that this is not intended as a do-it-yourself manual for prospective airport owners. It will, nevertheless, be a most useful guide for authorities who are planning new airports, or extensions to older airports, and who need to modernize their thinking before discussing the plans with users and prospective users.

Thinking on most aspects of the subject appears now to have settled down and there is no very wide divergence of views on essentials. For instance, the overall opinion, as might be expected, is against open apron systems and in favour of variants of the pier-finger system. These variants may be considered as including the satellite system, which has the advantage of leaving the aprons clear, but the disadvantage of high cost. The airlines do not appear to be in favour of the more complex form of satellite plan in which the satellites are sub-terminals containing all the usual airline facilities for passenger handling.

Since the first edition was issued there has been ample practical experience of the turbojet noise problem and a good deal of attention is paid to this subject and to the related problems of blast, heat and fumes. Practical experience has been gained, too, of transport units carrying passenger-numbers in excess of 100.

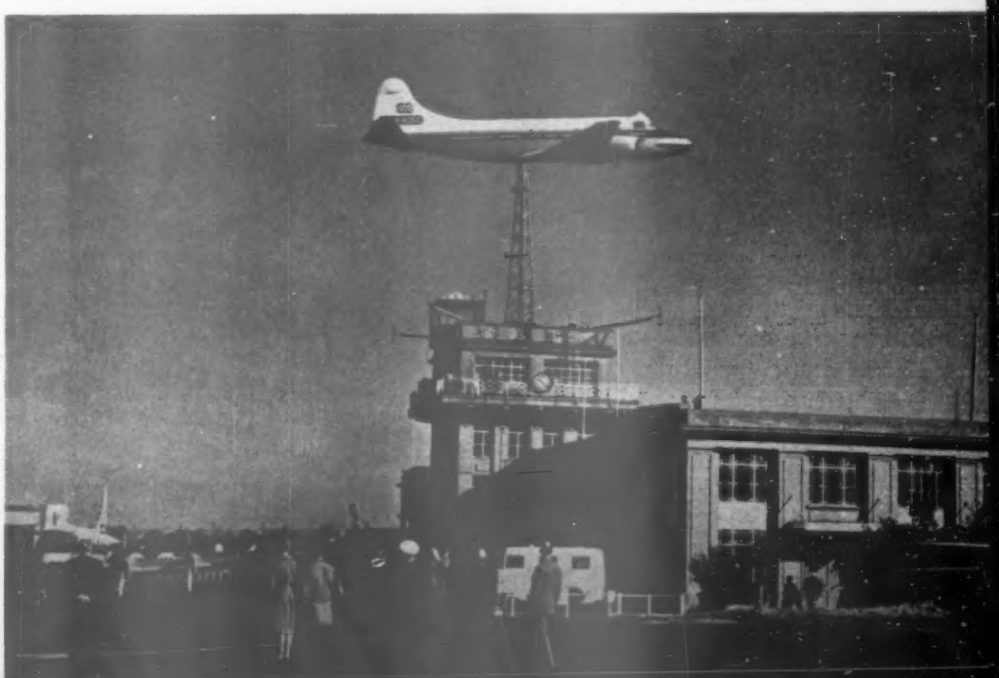
An example of consolidated airline thinking on a question which has been unanswered in the past is that it is essential for aircraft to be permitted to manœuvre on the apron under their own power and that "experience has not given any indication that the auxiliary wheel drive devices are satisfactory for airlines' operations."

The effect of the introduction of still bigger aircraft can be seen in many sections of the manual and to the earlier terminal traffic-flow plans has been added a three-level system —one level for domestic passengers, one for international passengers and a ground-floor level for baggage and servicing supply movements. Freight handling, too, is covered at greater length.

Arctic Service Hitch

BECAUSE of doubts about the accuracy of day-to-day take-off handling techniques, the F.A.A. recently increased, as an interim measure, the Boeing 707-320's VR speed by 7 kt. and the V2 speed by 5 kt. At high weights these speeds—for nosewheel lifting, or rotation, and unstick—are fairly critical; training and test-flight data with the Intercontinental have suggested that they might be a little on the low side. The increases mean that runway requirements will, at least temporarily, be increased.

A direct result is that Pan American's U.S. West Coast-London flights have been re-routed to shorten the first east-bound leg and thus reduce the take-off weight to the maximum permissible at San Francisco. Earlier plans had assumed a refuelling stop at Goose Bay, Labrador; instead the service stops at Boston (or at Gander, Newfoundland, according to wind conditions), thus reducing the distance on the first sector by about 325 naut. miles. The total, when using Boston, Great Circle distance flown via Boston is about 5,180 naut. miles by comparison with 4,810 naut. miles through Goose.



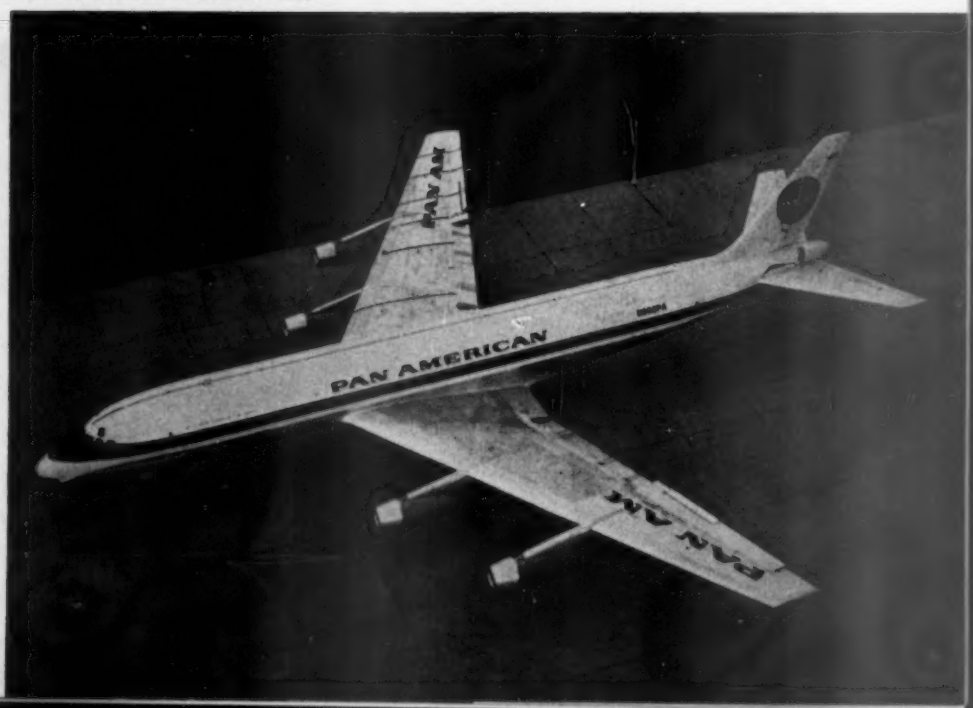
THE END OF AN ERA.—A Morton Air Services D.H. Heron leaves on one of the last flights out of Croydon, which was finally closed at 22.30 hrs. on September 30 after 43 years of active use—for much of the period as London's Number One civil airport.

Douglas DC-8 in Service

New pictures of the second U.S. turbojet transport in scheduled operation.

The Douglas DC-8, powered by four Pratt & Whitney JT3C-6 turbojets, was awarded its F.A.A. type approval on August 31 and was put into regular service on September 18 by Delta Air Lines (top) and United Air Lines (left). The picture above shows the fuselage-width eight-seat first-class lounge in the United DC-8s, which are 113-seaters (60 first, 53 coach) and are flying initially one round trip a day between New York and San Francisco. The Delta DC-8s have 40 first-class and 72 coach seats and a seven-seat lounge and fly daily between New York and Atlanta.

Next version of the DC-8 to be certificated, in December, will be the domestic model with JT4A-3 engines and a gross weight of 276,000 lb. In the same month, the first intercontinental model, with these engines and a 300,000 lb. weight, will also be approved, followed by the Conway-engined model in February, 1960. A JT4A-engined DC-8 in Pan American markings is illustrated, right.



Only the VANGUARD has this future while making money right from the start

THE VICKERS VANGUARD is designed for growing traffic, yet it will make profits right from its introduction with payloads no bigger than those carried by Viscounts today.

This is clearly shown in the illustration. Profit begins with the first 500-mile trip carrying no more than 42 passengers and 640 lb of freight. Even on modest estimates of traffic and freight increases, its profits will grow considerably with the years.

Assuming a 10% increase per annum in traffic, and 7% in freight, annual and cumulative profit at the end of seven years is remarkably high. By employing the Vanguard's cheap-fare possibilities, payloads and profits could be much higher.

YEAR	PASSENGERS	FREIGHT	MAIL	TRIP PROFIT
[illegible]	42	640 lb.	250 lb.	$129
[illegible]	50	735 lb.	250 lb.	$490
[illegible]	61	840 lb.	250 lb.	$930
1964	74	960 lb.	250 lb.	$1,450
1966	90	1,100 lb.	250 lb.	$2,100
1968	103	1,260 lb.	250 lb.	$2,870

This diagram shows trip profit on a 500-mile sector at realistic European costs and current tourist fares. The start-point is 42 passengers and 640 lb of freight in 1958.

NOTE
The table which appeared in our advertisement of 18th September was incorrect

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

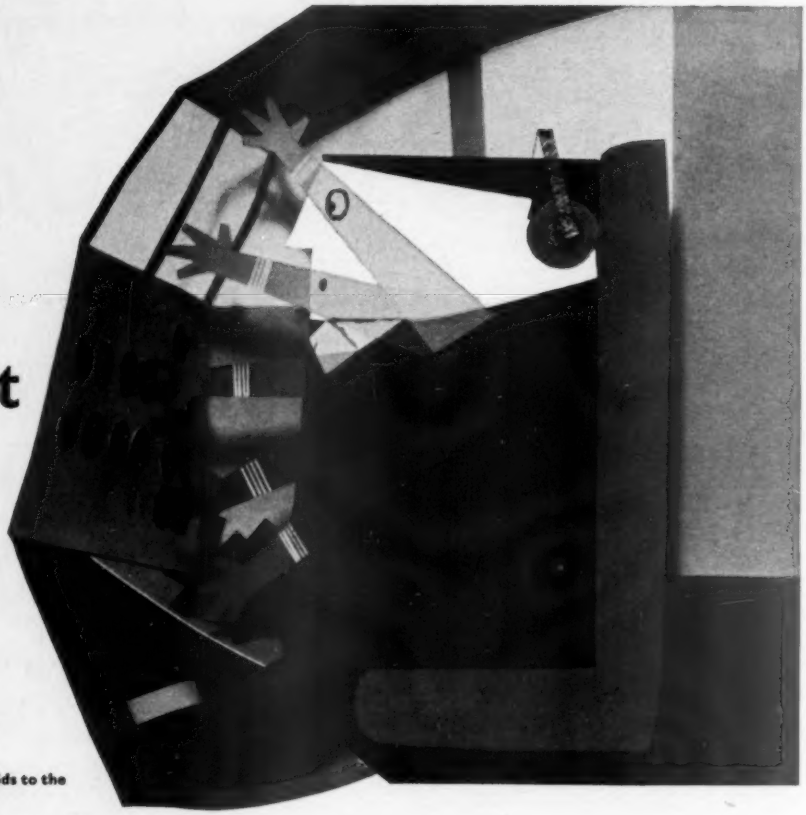
• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

AT 638

C

working pilot

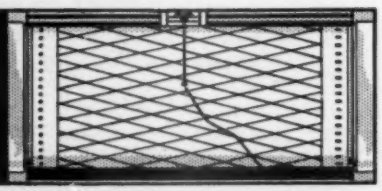


The IFALPA delegate speaking on point source aids to the ICAO Special Meeting, Montreal, February 1959

....**"It is a most unfortunate time to have to be fiddling with a receiver.** In order to tune in this type of station, you must switch off all of your other communications or else you will never pick up the Identification. One man in the cockpit is completely concerned with just one thing: tuning in the station – pressing his hands against his ears until he *can* identify it. The other man takes over the entire communications guard; continuously receiving clearances stepping the ship down, and also slowing it down; at the same time he is also operating a check list; this calls for conversation between himself and the other pilot if he can finish with his station identification. It is a very poor time to be distracted and pre-occupied with tuning a facility . . . there are eight holding stacks and of these six are non-directional beacons and the other two are intersections of radials from VORs. Holding on an intersection of two radials, you will be in a pattern something like this – one minute on this leg, a one minute turn, one minute on this leg, another minute turn and you are back where you started. On your Symbolic Display you centre the needle indicating the VOR radial from the left side; the VOR on the other side has a needle that is off-set, and as you approach the intersection, the needle on the other one will come into the centre—only at that one instant do you know exactly where you are. You then punch a stop watch and start a turn, using your directional Gyro and Turn Indicator—incidentally, you must hold your altitude with considerable precision because there are people above and below you in the stack. As soon as you leave this point both needles will be at various positions on the face of the dials and extremely difficult to interpret. As you come back into your pattern, the needle on the left should centre itself. If it does not you have wind drift, and you have a minute in which to correct it and bring it back into the centre. **'IS PICTORIAL PRESENTATION DESIRABLE?'** I would say that it most definitely is. There is only one instant in this four minute pattern when you know exactly where you are, and that is only if within that minute you have been able to re-align yourself"...

...but you always know where you are with

THE DECCA NAVIGATOR



THE DECCA NAVIGATOR
COMPANY LIMITED
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THE NAVIGATION SYSTEM FOR THE JET AGE

The Fighting Services

Victors to Teheran

TWO Bomber Command Victor B.1s of No. 57 Squadron (Wg. Cdr. K. C. Giddings, O.B.E., D.F.C., A.F.C.) from R.A.F. Honington, are to visit Teheran for the Imperial Iranian Air Force Day on October 18.

The aircraft will be under the command of Air Marshal Sir Kenneth Cross, A.O.C.-in-C., Bomber Command, and will be accompanied by a Comet 2 of Transport Command. They will arrive in Teheran on October 16, and will be on display at Mehrabad Airport on October 17. The following day the aircraft will take part in the flying demonstration organized by the Imperial Iranian Air Force.

P.R. Invention Award

FOR his invention of the first photographic reconnaissance sight for operational flying to be used in the R.A.F., Sqn. Ldr. R. L. E. Burton, A.F.C., R.A.F. (Retd.), who as a Flt. Lt. won the England-New Zealand Air Race in 1953, has been awarded £225 by the Committee on Awards to Inventors.

Previously a P.R. device known as the "banana sight" was used primarily for survey photography. The new sight provides means for determining the point on the ground vertically below the aircraft, to ensure that the aircraft is flying on the correct track; means for determining the line of sight of the camera, to ensure that the photographs are centred on the track being flown; means for establishing a particular heading and determining drift angles; and means for determining the setting of the camera timing control.

Sqn. Ldr. Burton's sight, known as P.R. Sight Type 1, solves the problems that arose with the introduction of faster jet reconnaissance aircraft. He designed it while serving at R.A.F. Benson, and its prototype was used in a Mosquito of No. 540 Squadron.

High Attendances

SEVENTY THOUSAND people visited the R.A.F. Battle of Britain exhibition on Horse Guards Parade between September 14 and 20. In addition 27,500 people—more than twice as many as last year—went to the indoor exhibition at Air Ministry, Whitehall Gardens, where they saw wartime films of the air battle over southern England, together with working models of a modern airfield protected by Bloodhound ground-to-air missiles. There was also a large display of *Punch* cartoons dating back to the First World War, showing the lighter side of R.A.F. life, and models of many of the latest aircraft in service.

To Reduce a Hazard

TRIALS of an experimental sound reproduction system which, it is hoped, will keep R.A.F. airfields free from birds are to be conducted in the near future. The cries of certain common species, broadcast through amplifiers, will, it is thought, cause birds invading R.A.F. airspace to take fright and fly away.

The apparatus consists of six 8-ft.-high loudspeaker assemblies, two amplifiers and a tape-recording unit. As the main danger of collision lies in take-off and landing, the loudspeaker units are to be placed along the length of runways and as close to them as safety regulations permit. The remaining equipment is housed in Air Traffic Control, from which the system is controlled.

The "talking scarecrow," as the system is known, is to be evaluated by means of trials at three separate airfields in the United Kingdom. One will be the R.A.F. College, Cranwell, where a great number of bird strikes have been reported during the past three years, another is R.A.F. St. Mawgan, and the third, a Bomber Command station, is still to be nominated.

Species hit by Service aircraft in the U.K. include wood pigeons, starlings, plovers, crows, seagulls and duck. Some birds have been encountered as high as 1,000 ft. The value of the system as a flight safety measure will be difficult to assess precisely and a carefully conducted trial extending over a considerable period may be necessary.

This is the latest in a series of bird-scaring measures tested by the Service since the War. In 1947 and 1948, for example, peregrine falcons were used, but the experiment was not a success. Some devices have proved temporary deterrents, but familiarity would seem to breed no less contempt in the ornithological field than in any other.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. R. L. W. Baelz, D.F.C., Sqn. Ldr. R. C. P. Thomson, with acting rank of Wg. Cdr., both to the Department of the Chief of the Air Staff.

Bomber Command: Gp. Capt. A. W. Heward, O.B.E., D.F.C., A.F.C., to R.A.F. Finningley, to command; Sqn. Ldr. G. W. Turner, D.F.M., to R.A.F. Scampton to command the Administrative Wing, retaining the acting rank of Wg. Cdr.; Sqn. Ldr. W. J. H. Roberts to R.A.F. Finningley, to command No. 101 Sqn., with the acting rank of Wg. Cdr.

Fighter Command: Wg. Cdr. L. A. Parr to R.A.F. Boulmer.

Transport Command: Wg. Cdr. J. W. Allan, D.S.O., D.F.C., A.F.C., to R.A.F. Northolt, to command the administrative wing.

Technical Training Command: Wg. Cdr. W. C. Armstrong to No. 1 Radio School, R.A.F. Locking, to command No. 3 Wing.

R.A.F. Germany: Sqn. Off. M. E. M. Riddell to Headquarters, as W.R.A.F. Administrative Officer, with the acting rank of Wg. Off.

Other Appointments: Gp. Capt. J. A. R. M. Reid, to the Ministry of Supply as a Member of the Ordnance Board; Wg. Cdr. P. J. Kelley, D.F.C., to the N.A.T.O. Standing Group, Washington.

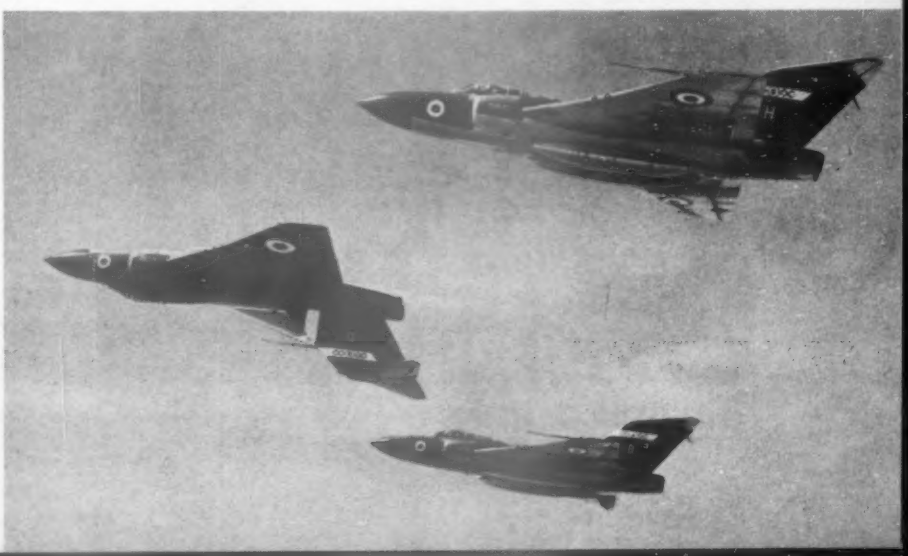
Notes and Events

Benevolent Fund Retirement.—Gp. Capt. S. J. Bailey, appeals secretary of the R.A.F. Benevolent Fund since 1940, has retired. During the period he has been secretary, £3 million was received by the appeals committee and the Fund spent over £6 million on relief. Gp. Capt. Bailey is succeeded as appeals secretary by Gp. Capt. G. P. Woodhouse.

R.N.A.S. Brawdy.—The R.N. Air Station at Brawdy, Pembrokeshire, is to continue in commission until at least 1962. In February, 1958, the Admiralty announced that the station would be closed in 1960, and kept in reserve for commissioning if required.

No. 208 Squadron.—The annual reunion of No. 208 Squadron Old Comrades Association will be held at the Swiss Hotel, 53 Old Compton Street, London, W.1, on October 24. Tickets, price 7s. 6d. each, are available from the Hon. Sec., R. W. Booker of 28 Greet Road, Lancing, Sussex.

No. 85 Squadron.—Fourteenth annual reunion will be held at The Victory Ex-Services Club, Seymour Street, London, W.2, on November 14, 1959. Tickets, 18s. each, from J. Roberts, 60 Swanfield Road, Waltham Cross, Herts.



LEADERSHIP.—Three Javelin FAW. 7s of No. 64 Squadron (Wg. Cdr. J. A. Wright, M.B.E., D.F.C.) in an unusual Vic formation for all-weather fighters. The Squadron shares its base at R.A.F. Duxford with No. 65 Squadron, operating Hunter F.6s.

Photograph copyright "The Aeroplane and Astronautics"

A STOL Aircraft With Slipstream Boost

By G. Bruner

A GENERAL consequence of the improvement of aeroplane performances is the increase of landing and take-off speeds and the extension of runway lengths beyond all reasonable limits. Efforts are now being made to improve this situation, that is, to decrease the approach and take-off speeds without modifying the cruising speed too much.

One of the more classical means of achieving this is to increase the action of lift-boosting systems. The limit of their mechanical development is drawing near—the number of flaps and the number of slots which open as these flaps are lowered have been increased, and the lift values obtained seem to reach a maximum located between a C_L of 3.3 and 3.6.

Previous observations have already showed that the slipstream of a propeller placed in front of the leading-edge of a wing considerably increases the lift of this wing when its flaps are lowered. This led the engineers of the Louis Bréguet company to design a wing which is equipped all along its trailing-edge with a group of multiple flaps having very steep deflections (which may reach 90°), and exposed to the permanent slipstream of four large propellers placed in front of the leading edge (Fig. 1).

This arrangement strongly deflects the slipstream downwards and considerably increases the lift. Under certain conditions the lift value reached was found to be twice that of the same wing not exposed to the slipstream.

As a result, the landing speed could be greatly reduced and the speed range considerably improved. Moreover, the slipstream increases the drag of the wing with lowered flaps; this decreases the lift-drag ratio of the aircraft and makes possible steep-angle approaches which were impracticable until now. Small airports, surrounded by rather high obstacles can, therefore, thus be used.

Aerodynamic Problems

Let us examine the balance of forces acting on the wing and powerplant during the landing (Fig. 2). OA is the descending path of the aircraft and α is the angle between this flight-path and the propeller axis. The wing is equipped with two trailing-edge flaps; the first, B, is short, the second, C, is longer. This latter flap is equipped with a front slot, D. When the whole group is lowered it uncovers three successive slots, and flap C may reach a deflection of 80° from its initial position.

The action of the air—including the slipstream—on this group of flaps and slots generates aerodynamic forces L and R, normal and parallel to the flight-path respectively. Their resultant, F, may be geometrically combined with the thrust of the propeller, T, giving a vertical force, Q, equal and opposite to the weight of the aircraft, P.

This balance of forces corresponds to uniform motion along the flight-path during what is usually termed the "approach."

Generally, the value of T is relatively small and corresponds to only part of the thrust of the propellers—which are specially designed to have high thrust. Thus full power cannot be used in this landing manœuvre. It would, however, be profitable to use the maximum slipstream, because its effect will give a high value to the lift coefficient C_L obtained with the flap-equipped wing, and the speed along the approach path will be decreased.

The only way of absorbing a large propeller thrust is to increase as much as possible the drag component of the aircraft. The very steep deflection given to the multiple flaps which uncover several slots is one way of creating high lift as well as large drag. The steeper the flight-path angle β, the more necessary it is to increase the drag. Special means, mentioned later, will enable this drag to be artificially increased.

During take-off (Fig. 3) there is quite a different state of affairs. Combining aerodynamic resultant forces L and R into F, and combining F with the propeller thrust T, giving a vertical force Q equal and opposite to the weight P, fits in very well with a high value of T. One must even try to have the resultant F as near to the vertical as possible—that is, to have the smallest R/L ratio. For this the flaps would not be lowered much and the large propeller slipstream would be very favourable to an increase in the wing lift and thus to a decrease in the take-off speed; consequently small airfields may be used.

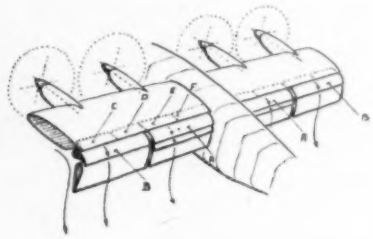
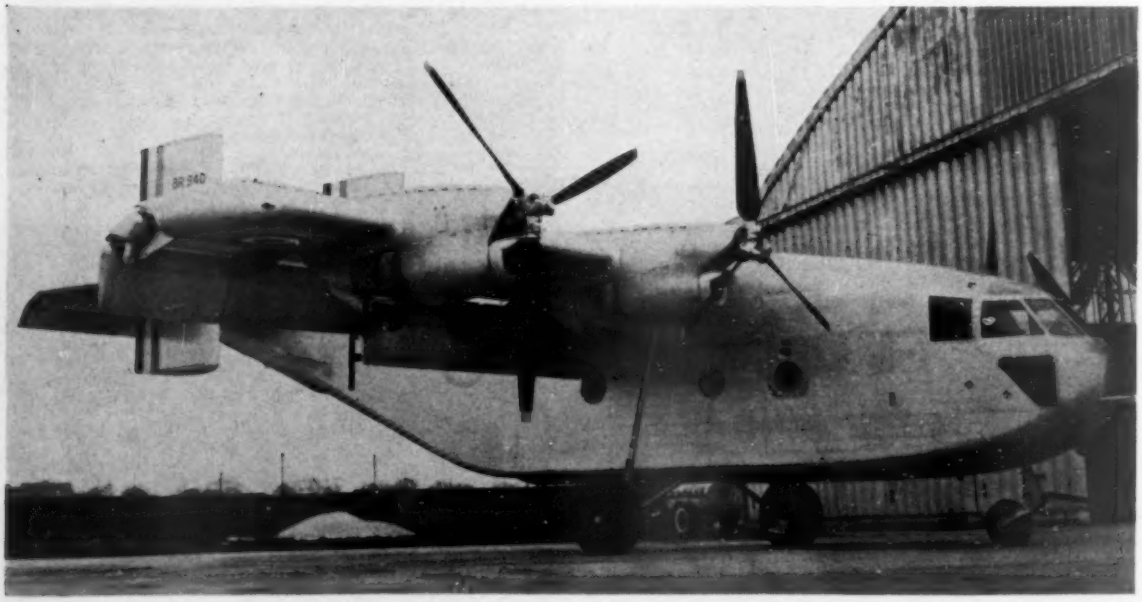


Fig. 1. The general layout of flaps and large propellers used as the basis of the Bréguet STOL projects.

The four turboprop engines placed in front of the wing are mechanically interconnected. It would indeed be dangerous to have the four engines entirely independent, for should one of the outboard engines stop, the large difference of lift due



This view of the Bréguet 940 shows to advantage the thick high-lift wing section used, and the complex flap system.

A steep-angle take-off and climb-away. In this view can be seen the high set tail unit with twin fins and rudders.

to suppression of the slipstream could give rise to a very dangerous rolling couple. Also if one of the outboard propellers stopped, a very large yawing couple would be generated, because a large thrust would have disappeared and the propeller is quite distant from the aircraft centreline. Adding the two effects might even result in a spin.

Advantage was taken here of the design of a particular type of turboprop engine with two mechanically separate elements

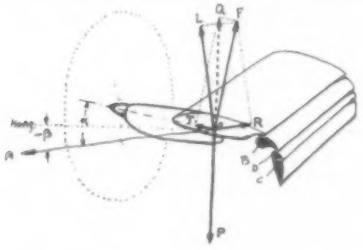


Fig. 2. A force diagram representing the landing phase.

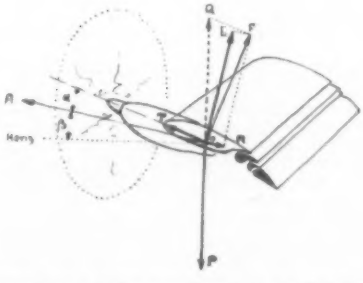


Fig. 3. A force diagram for the take-off condition.

(Fig. 4)—a " gas generator " A (which consists of a compressor C, a combustion chamber D and a turbine E) and a free turbine B. It is the four free turbines which are interconnected by an articulated shaft F placed along the wing leading-edge.

Each propeller is driven by a shaft G and reduction gears H and L*. Thus the four propellers always revolve together at the same r.p.m.; their action can be differentiated only by changing their individual pitch. Each engine is started individually by starting its generator; the transmission mechanism for the four propellers is driven only by the ejected gases passing from turbine E to the free turbine B. Thus a regular slipstream distribution over the whole wing is obtained.

Aerodynamic Tests

The problem, being entirely new, was very systematically studied. A whole series of successive tests was made in order to verify theoretical predictions and calculations. A satisfactory system could also be worked out and flying tests thus became easier.

(1) Aerodynamic tests started with a series of detail tests between panels on a constant-thickness wing section equipped with flaps for tests without propeller slipstream. Different arrangements were tried out with, in principle, two successive flaps, the second one being equipped (in the central portion of the wing) with a supplementary front slot added to improve the air flow. Once high lift values had been obtained (C_1 being well over 3) the next stage was started.

(2) A comparatively large-scale (1 : 7.5) motorized model of the aircraft, equipped with all its flaps and moving control surfaces, was built. Four variable-frequency electric motors drove the model's small propellers. The wind-tunnel tests done at Bréguet in a 3m. × 4m. rectangular tunnel, were done on a series of arrangements with variation of pitch and of flaps and control surface angles.

The major purpose of these tests was to determine the quality of air flows and the stability and performance of the aircraft.

(3) A flight simulator, based on an analogue computer, was then designed. A control cabin with a stick, rudder pedals, throttle and pitch controls and an instrument panel was built and electrically connected to the analogue computer. On the basis of results obtained from the aerodynamic tests on the motorized model, flight equations were established and entered into the machine. When the cabin controls were handled, answers appeared on the instrument panel indicators, showing the flying speed, climbing speed, incidence, skid, and damping of the aircraft's movements.

(4) To verify these results in a more tangible way, a lightweight flying model, externally identical to the aircraft, was built. The moving parts were remotely operated and a variable-frequency electric motor placed in the fuselage drove the four propellers through a shaft placed in the leading-edge of the wing. The model was suspended by a shock-absorber cord from the ceiling of the test section of the Chalais-Meudon wind-tunnel, and was remotely piloted from a control cabin equipped with two sticks and a rudder bar.

The results of all these tests agreed beautifully and enabled flying tests to be started with confidence.

To test the operation of the engine units and of the

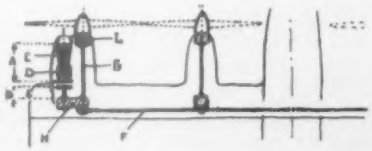
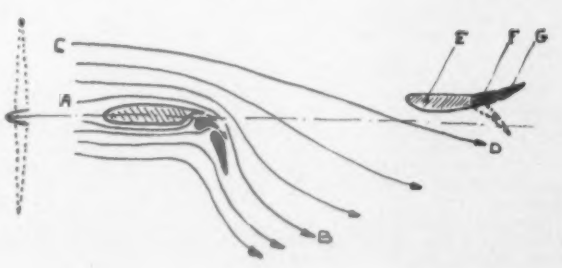
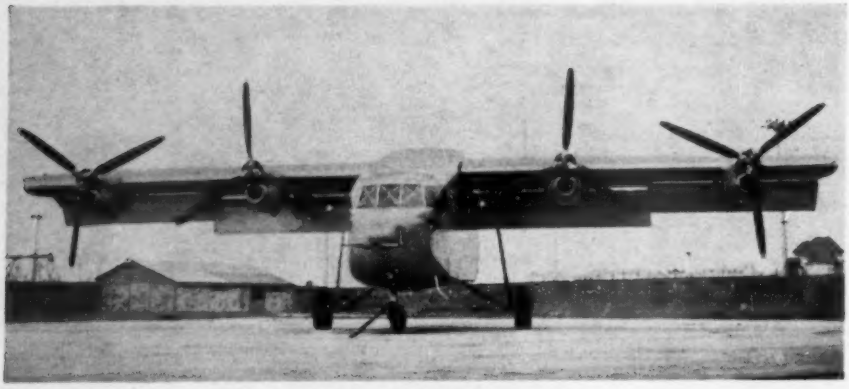


Fig. 4. (Right) Powerplant layout.

Fig. 5. (Below) Downwash from the wing and flap system.



* In Fig. 4, to make the explanation easier, the outboard engine has been rotated through 90°; shaft G really runs above gas generator A.



This head-on view shows the relatively short span wing and the large-diameter propellers giving slipstream-boosted lift over the whole wing.

transmission mechanism, a test bench was built. This consisted of the wing, with its four engines and the transmission mechanism, and the whole arranged on a special frame. Thirty-five hours of operation at different speeds were gone through without encountering serious difficulties.

The Br 940 Experimental Aircraft

The special Br 940 aircraft is propelled by four Turboméca Turmo II turboprop engines of 400 s.h.p. each. The r.p.m. reduction is large so as to have the propellers revolve at about 1,000 r.p.m. The engines are set far above the ground, on account of the clearance needed for the large-diameter propellers, and this automatically gives a high-wing layout.

The fuselage section is rectangular. The front part of the fuselage contains a control cabin for a pilot and a mechanic seated side by side. A central hold is used at present to house the test engineer and the instruments which record the flight characteristics. The rear end of the fuselage is steeply raised with an articulated hatch giving access to the hold by means of a sloping ramp

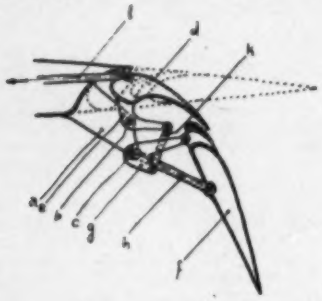


Fig. 6. The inboard lift-increasing flaps of the Bréguet 940.

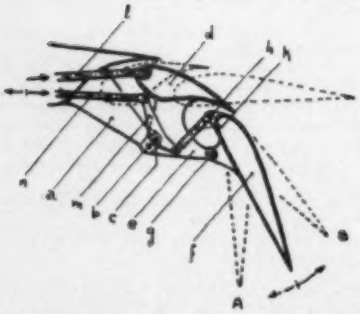


Fig. 7. The outboard flaps, differentially operated as ailerons.

The large horizontal tail unit is set on the top surface of the fuselage, even slightly higher than the wing. This arrangement was chosen so as to keep this surface out of the strongly deflected wing downwash (A-B, Fig. 5). The flow and incidence of this downwash are extremely different between flight with and without flaps. The flow above surface C-D varies much less, but there is a variation, and because of this a horizontal tail unit with variable incidence during flight was planned.

However, the deflection remains large and, to avoid a stall, an asymmetrical, upside-down section was chosen for the tail unit (E). In addition, the propeller thrust passes above the centre of gravity of the aircraft, and when the flaps are moved out the centre of pressure of the wing is moved back; these two factors generate a diving moment.

Moreover, it is a known fact that a powerful propeller slipstream generally disturbs stability. On account of these two conditions, the horizontal tail-unit was oversized and its control surface was equipped with two flaps placed one behind the other (F and G) so as to increase its efficiency. By this means the problem of low-speed control response was solved.

The aircraft has a double rudder carried by the horizontal tail. Each rudder surface is thus placed in the propeller slipstream. Their action seems very satisfactory.

The rectangular, constant-section wing carries on its trailing-edge two groups of flaps. Those nearer to the fuselage are used only to increase the lift (A, Fig. 1 and Fig. 6), whereas the outboard flaps (B) are used also as ailerons, thanks to the second flap which has been given a differential motion, independent of the general deflection (Fig 7). They still operate correctly at low flap deflection and the aircraft is flown like an orthodox type. Their efficiency decreases when the group of flaps reaches steep deflections (A and B, Fig. 7); the rolling effects are smaller, yet large adverse yawing moments appear.

Two different processes, which may be applied separately or together, have been used to correct this deficiency:—

(1) The pitch of the outboard propellers may be varied differentially. This variation is combined with the rolling control (steering wheel on the stick). The pitch is increased on the side of the wing which has to be raised; the slipstream slightly increases the lift on this portion of the wing and the increased propeller thrust makes the plane rotate about the lowered wing, correctly creating the yaw required.

At present the Br 940 flies with its inboard flaps at 80° deflection and its outboard flaps at about 55° only. With this arrangement, the rolling efficiency with ailerons plus differential thrust seems sufficient.

(2) Spoilers are arranged along the trailing-edge of the fixed portion of the wing (C, D, E, F, Fig. 1 and A, Fig. 8). When they are raised on the side of the wing, which must be lowered, a rolling couple is created, but no adverse yaw is generated.

On the flying model, all combined associations of ailerons, differential and spoilers were tried. In case of maximum flap deflection, association of the three systems gave the best results. Flying tests are being continued.

The tricycle-type, fixed landing gear uses two triangular members attached to the fuselage bottom and two very long shock absorbers secured to the wings. A non-retractable gear was chosen for simplicity, as the aircraft was designed for low-speed testing only. The wheels are equipped with hydraulic brakes.

During the approach flight, it is useful, as explained above, to increase the propeller slipstream, by raising the engine power, and this calls for an increase in drag. A new process used (known as " transparency ") consists of a rational utilization of the propeller thrust. The pitch of the outboard propellers is made considerably less than that of the inboard propellers. Thrusts and slipstreams are thus practically

Fig. 8. Spoilers are installed at the trailing-edge of the fixed part of the wing at A.

non-existent at the wing-tips, the power of the four turbo-shafts being concentrated on the inboard propellers.

If, in the case of regular slipstream distribution, the lift distribution along the span may be considered as elliptical (curve A, Fig. 9), the distribution obtained in the "transparency" pattern is more concentrated at the centre of the wing (curve B). Such a distribution corresponds to an effective decrease of the aspect-ratio of the wing and this increases the drag and decreases the lift-drag ratio.

It is possible to fly down with more power, therefore, with a stronger slipstream, at a lower flying speed and at a steeper angle. Obstacles surrounding the airport can be cleared more easily.

When the aircraft touches-down, the propeller slipstream does not disappear at once, because the power is still on during landing, and the ground friction is not strong enough for the wheel brakes to have sufficient effect. It is thus absolutely necessary to reverse the propeller pitch. Beside the direct slowing down action obtained by this method, the slipstream on the wing is suppressed and the wheel brakes can have immediate effect.

Results of the Flying Tests

The first series of flying tests were aimed at studying the take-off.

A take-off at total design weight was made after a 90-m. (300-ft.) run and clearing 15 m. (50 ft.), 190 m. (625 ft.) from

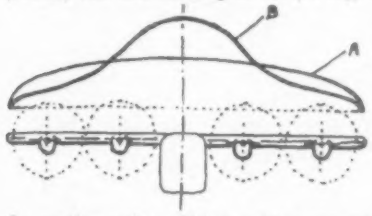


Fig. 9. Lift distribution over the span showing the special distribution arranged for landing with the Bréguet STOL projects (curve B).

the starting point. This is quite a remarkable performance for an aircraft having such a heavy wing loading.

A climbing slope of 25% near the ground was reached; this value is considered to be very satisfactory. During this take-off, made at 6,500 kg. (14,300 lb.) weight with 47.4 m.² (510 sq. ft.) of wing area and at a speed of 25 m. per sec. (50 knots), the lift coefficient reached a value of $C_L = \frac{16 \times 6500}{47.4 \times 25^2} = 3.5$, which is almost twice the lift coefficient without slipstream recorded during the wind-tunnel tests; inboard flaps were set at 40°, outboard flaps at 20° only.

Steep angle lowering of the flaps was then studied, and with 80° incidence for the inboard flaps and 55° for the outboard flaps, the results obtained (with no wind) were:—

A stalling speed of about 20 m/s (40 knots), which corresponds to C_L max = 5.5; a descent slope of the order of 17% with a speed of 25 m. per sec. (50 knots) along the flight path. The total landing distance to clear a 15-m. (50-ft.) obstacle is of the order of 200 m. (650 ft.).

This last phase of the tests continues; the programme includes setting the outboard flaps at a steeper angle, in the hope of obtaining even better results.

The Br 941 and Br 942

An aircraft of about 17 tons total weight, for practical utilization, is under study and production is beginning. There are two different versions—the Type 941 for civilian and military cargo carrying (the full-scale mock-up was shown at the Paris International Air Show last June), and Type 942, a passenger transport with a pressurized cabin.

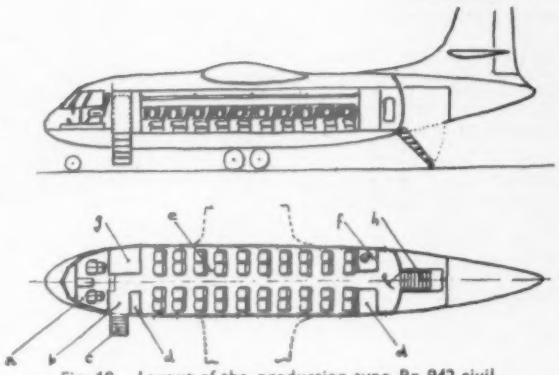


Fig. 10. Layout of the production-type Br 942 civil transport project.

The engines will be de Havilland Gnome turboprops, developing 1,250 s.h.p. each (future development will reach 1,350 s.h.p.).

This aircraft has a high trapezoidal wing, a single central rudder, with a horizontal tail placed at quarter of the height of the vertical tail. The fuselage of the civil Br 942 (Fig. 10) includes a cockpit for two pilots (a); a lobby (b) with an inbuilt staircase in the door (c); holds for hand-luggage, placed there by the passengers themselves as they enter the aircraft (d); a passenger cabin for 40 people (e); a washroom (f); a hold for registered luggage (g), and a second inbuilt staircase (h). The front and rear entrance doors are large enough to be used for loading parcels when the aircraft is used in a dual-purpose rôle or as a commercial freighter.

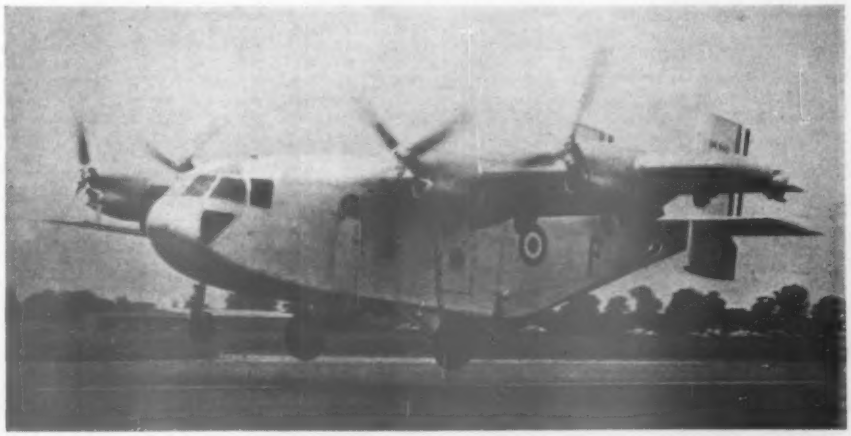
At the rear of the cargo version the fuselage bottom can be opened; it can either serve as an access ramp for self-propelled vehicles when lowered, or, in a horizontal position, make possible direct loading from a truck platform. Two side doors open about the horizontal hinges so as to clear the entire back of the hold.

Utilization

As they can take-off and land in short distances, both the civilian cargo version and the passenger transport will be able to use small airfields, either tourist fields or even heliports 300 m. (1,000 ft.) long, located in the vicinity of urban centres. It even seems that the tasks assumed until now by civilian helicopters will be performed by these new transports with considerably higher cruising speeds—in the region of 400 km.p.h. (220 knots) instead of 150-200 km.p.h. (85-110 knots) for helicopters—a greater number of passengers and a much more economical operation. The civilian passenger version will make a real "aerobus" able to ensure relatively rapid connections between close communities.

Should the available take-off ground be larger—400-450 m. (1,300-1,500 ft.) long—the aircraft may operate at weights up to 20,000 kg. or 44,000 lb.; it may thus undertake journeys of up to 1,500 km. (950 miles) and the trip may be made at a height of 7,000 m. (23,000 ft.).

The hope may therefore already be expressed that the new slipstream-exposed "blown-wing" formula will mean a further step towards solving the problem of transport aviation on a country's interior network.

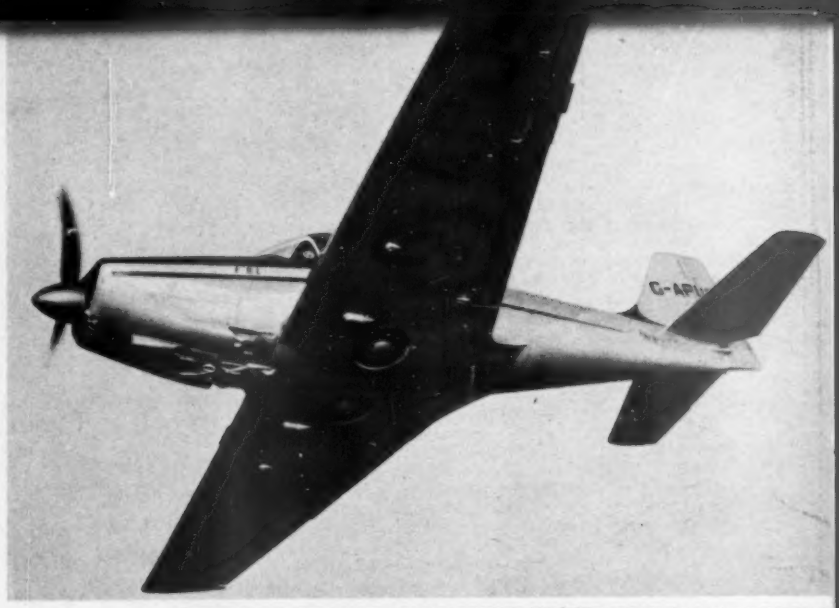


The overall compactness of the Br 940's layout is particularly noticeable in this take-off shot.

THE AEROPLANE and ASTRONAUTICS OCTOBER 9, 1959

Flying the Falco

By John Fricker



STARVED of indigenous products, the light aeroplane market in the U.K. is now wide open to American and Continental types, since the relaxation of import restrictions (although not of import duty). Foreign companies have not been slow to take advantage of a demand which most sections of the British aircraft industry have denied existed, and competition is now becoming intense.

We have seen, and sampled, a steady succession of mouth-watering designs, each offering some attractive combination of performance, comfort, efficiency and economy. Through advanced engineering, cruising speeds up to 100% higher than in existing British designs are being achieved, using engines of no greater power, although of much more modern design.

As the latest arrival among these newcomers, the Italian Aeromere Falco F.8-L is also perhaps the most attractive, as well as among the most exciting. On its 150 b.h.p. Lycoming O-320-A flat-four engine, this superlatively sleek example of imaginative aerodynamics will carry two people at a claimed cruising T.A.S. of 185 m.p.h., while returning something approaching 30 air miles per gallon of fuel. Notwithstanding this truly remarkable performance, its light and compact structure has an ultimate load factor of 9.4*g* coupled with fighter-like handling characteristics, permitting all normal aerobatics to be performed.

In short, the Falco is thoroughly Continental in conception, and inevitably invites comparison with an Italian sports car. It has a similar miniaturized grace and emphasis on performance, which, however, is not achieved to the detriment of low-speed handling. The Falco is both docile and viceless, and by no means as "hot" as its initial appearance might suggest, with an innocuous stall in the region of 60 m.p.h.

How, then, is this combination of virtues achieved? Approaching G-APUO, the first British-registered Falco at Denham, where it is kept by Mr. C. H. Cosmelli, who has the British agency for the type, the first clues were given by its very compact dimensions and mirror-like surface finish. Except for the metal flaps, cowlings and control surfaces, construction is entirely of wood, evidenced by its fluid lines, and the fact that its maximum gross weight is a mere 1,700 lb.

Wood is nowadays sometimes regarded as an outmoded material for aircraft, but unlike metal, it is fatigue-free, easy to repair and has a good strength-weight ratio. As we recently saw in the American Mooney Mk. 20, it also facilitates the design of a particularly clean wing, which is so important for high performance. Few other lightplanes, however, can have had so clean a wing as the Falco, the burnished silver skin of which clothes a NACA 64000 laminar-flow section tapering from 12½% t/c at the root, to 10% at the tip. Even the root walk-ways are of smooth plastic material to minimize drag.

If the wings bring to mind stainless-steel razor blades, then the Falco fuselage is a small silver bullet surmounted by a large plastic bubble for the cockpit, and perched on stilted tricycle undercarriage legs to give clearance for the big variable-pitch airscrew. Blade and bullet are blended smoothly together by large wing-root fillets, while the integral fin sweeps forward in a dorsal spine to the cockpit. To fit within the wing, the undercarriage mainwheels have high-pressure tyres, and oleo legs with levered suspension for compensatory shock-absorption.

The Lycoming is closely cowled, with small fairings each side for the individual exhaust-stub outlets, and a ventral intake for the carburetter. Behind this is the nosewheel well, which curiously enough remains unfaired after undercarriage retraction, and half the tyre is exposed for belly-landing protection.

Cockpit layout is very simple, and the all-round view

absolutely superb, with the tiny wings offering hardly any obstacle to sideways vision. There is, however, no clear-vision panel for bad-weather flight, nor any apparent provision for opening the canopy in the air. The smoothly operating sliding canopy, with its blue-tinted roof panel, typifies the general workmanship of the Falco, which is obviously craftsman-built.

There is a surprising amount of room in the cockpit, which not only seats two large occupants in comfort side-by-side but also has enough space in the rear to accommodate a child weighing up to 66 lb., or a similar amount of baggage, when the rear fuel tank is not required. Little extension would be necessary to make the Falco a full four-seater, and this has already been done. With a 180 b.h.p. Lycoming 0-360 engine, the resultant aircraft is being marketed by Aviamilano as the F.14 Nibbio.

Aviamilano originally produced the Falco, to the design of Ing. Stelio Frati, but after initial deliveries of 10 F.8-L Series I aircraft in 1956, with 135 b.h.p. Lycomings, and 20 Series II, with the 150 b.h.p. engine, the present Series III is being turned out under licence by the Aeromere company at Trento. The earlier Falcos had wing-root fuel tanks, but the present series have a 15.3-gal. front-fuselage tank and an 11-gal. auxiliary container in the rear cabin. Individual gauges are on the starboard panel, and a selector is on the central console.

The Falco is intended for training as much as touring, and has full dual control except for a single heel-brake pedal on only the port side, and a single central throttle plunger. The control columns are bowed, Miles-style, for easier cockpit access,

and both seats adjust fore-and-aft for leg length. A full blind-flying panel is on the left, and basic engine instruments on the right, with electrical switches for flaps, undercarriage starter, generator, etc., in a central group.

All the normal mixture, carburetter heat, cabin heating and ventilation controls are grouped around the central throttle, but the Falco has no airscrew pitch lever or boost gauge. This is because the optional alternative to the standard fixed-pitch propeller is the counterweight-operated American Aero-Matic type, which automatically changes its blade-angle according to engine and aircraft speed. This principle has obvious advantages over fixed-pitch designs, for less expense and complication than with normal controllable-pitch airscrews, but the Aero-Matic installation on G-APUO does not yet appear to have settled down to produce the scheduled performance.

This first British Falco had done only 9¼ hrs. in the air when I flew it from Denham, which it had reached in just over four hours flying on its delivery trip from Trento, stopping at Strasbourg for fuel. After a short demonstration trip with Mr. Cosmelli, I moved over to the left-hand seat for some solo familiarization, before returning for air-to-air photography.

The Falco has a slightly unusual aerobatic harness, comprising two shoulder straps connecting with a quick-release clip

to a single strap passing between the legs from the floor. This harness is comfortable and quickly adjustable, but the absence of a lap-strap means that all one's weight rests on the shoulders under negative *g* conditions. The Falco's Lycoming is cleared for a maximum of 30 seconds inversion.

Ground manœuvrability when taxi-ing is entirely by means of the steerable nosewheel, which is linked to the rudder pedals, the mainwheel disc brakes being non-differential from the single central heel block. Moderate foot loads are required to turn, which can be done in a comfortably small radius. As I moved off over Denham's sun-baked turf, I was agreeably surprised at the very smooth ride conferred by the articulated undercarriage, and absence of pitching compared with some short-based tricycle types.

Grass airfields were obviously borne in mind by Signor Frati when designing the Falco, and this was a comforting thought when lining up in nil wind conditions on Denham's longest (but by no means too long) run towards the tall trees behind the cricket pavilion. I need not have worried. Opening up to full throttle and 2,700 r.p.m. resulted in an invigorating acceleration, plus the need for a little right rudder to keep straight, and we were airborne in a couple of hundred yards.

I had previously selected 20 degrees of flap with the three-position panel switch, and its mechanical indicator slot above the flight instruments, and the Falco unstuck at about 62-65 m.p.h., with an inch or two of aft stick movement. A noticeable point on entering the Falco had been the relatively small range of stick movement necessary to obtain full control deflection. This promised a sensitivity in handling which was fully realized on becoming airborne.

The ailerons proved particularly potent, with low break-out forces and a snap response more reminiscent of power controls and my initial climb-away was accompanied by a slight lateral wobble through momentary overcontrolling. This, again, is a typical Continental characteristic, and once one is accustomed to it, other aircraft feel like trams.

No perceptible trim change accompanied undercarriage retraction, via its safety-guarded switch in the centre of the panel. Like the flaps, the gear is actuated electrically, with a slightly long 15-second stowage time. Single green and red warning lights respond to undercarriage movement, and there are also position-indicating rods on inboard wing and front fuselage surfaces directly actuated by the landing gear legs. The unscreened electric undercarriage motor causes much interference through the radio, which in G-APUO is a British-installed STR-9X. The faint undercarriage warning horn is also linked with an engine fire detector.

On my first flight in the Falco, the engine was tending to overspeed slightly after take-off and during the 1,200 ft./min. or so initial climb. During a second trip, last week, after airscrew adjustment, the Aero-Matic unit consistently went into coarse pitch just after take-off. Precise control, in fact, of engine r.p.m. does not always seem possible with this airscrew, and in the later flights, with 2,200-2,400 r.p.m. indicated at full throttle in the climb, the engine appeared to be labouring at the recommended ascent speed of 100 m.p.h. Some rough running was also apparently due to excessively rich mixture, since leaning the latter out from ground level immediately restored smooth operation.

As its airscrew has not yet settled down, G-APUO was indicating at low altitudes only about 160 m.p.h. at the recommended cruising setting of 2,400 r.p.m., but several Falcos justified their manufacturer's 190 m.p.h. performance claims during the recent tour of Sicily. At 2,350 r.p.m. the cruising speed is claimed to be 180 m.p.h. for a fuel consumption of 6.1 gal./hr.

Noise level in cruising flight is moderate, although more robust than in corresponding American light aeroplanes, as one might expect from the Falco's sporting conception. Remarkably little change in trim accompanies alterations in speed or power setting, or indeed any difference in configuration. Elevator trim is by a convenient knurled wheel between the seats. This is sensitive and pleasant to use, although little needed, but its adjacent strip indicator works back to front.

Control harmonization is excellent at all times, the ailerons remaining lighter than the elevators and rudder, which are no less crisp in response. The Falco is decidedly positive in directional and longitudinal stability, and about neutral laterally, which, with its "finger-tip" controls, make it very pleasant to fly. Marked turbulence affected it only laterally; it rode the bumps hard like a jet fighter and required only minute stick displacements to keep straight and level.

With such responsive controls, aerobatics are, of course,

Photographs copyright "The Aeroplane and Astronautics"

The flying-photographs of the Falco show its extreme purity of line, marred, in the plan view, only by the unfaired nosewheel when stowed.

sheer delight, and may normally be done from level cruising flight. To loop G-APUO, a brief dive was necessary to 185 m.p.h., throttling back slightly to avoid overspeeding the engine, since in aerobatics, the Aero-Matic behaved more like a normal fixed-pitch airscrew. A light back pressure on the stick produced about a 4*g* pull-up, and a large-diameter loop, in which about 50 m.p.h. was indicated at the top. Elevator force could not have been more than 5 lb. per *g*, which compares favourably with most jet fighters.

The stubby wings and powerful ailerons make rolls equally simple, at any speed above about 150 m.p.h., and after raising the nose above the horizon, stick deflection will snap the Falco round at about 150°/sec., with no loss of speed or height. Normal aileron application, in fact, produces so rapid a roll that no negative *g* is apparent and there is no interruption of engine output. Aileron power remains almost as effective in rolls-off-the-top, from an entry speed of about 190 m.p.h., after the speed has fallen below that of the normal stall. Never-exceed speed of the Falco is 240 m.p.h., which is comfortably above normal cruising. Normal aerobatic load factors are +6 and −3*g*.

Low-speed handling of the Falco is equally impressive. At about 3,000 ft., I closed the throttle and raised the nose to try a clean stall. Speed fell-off quite slowly and the V.S.I. showed a slight climb, until pre-stall buffet was felt at about 74 m.p.h. The breakaway followed at about 68 m.p.h., accompanied by a mild wing drop.

In the approach configuration, with gear down, full 45° of flap, and a trickle of power, the Falco flew along in a ridiculously nose-high attitude under full control at about 70 m.p.h. Hard back pressure on the stick was needed to achieve a breakaway, which came with little warning at about 62 m.p.h. I.A.S. The manufacturers claim that the loss of height involved in this case is about 65 ft., and this does appear unduly optimistic from personal experience.

I did not spin the Falco, but it is fully cleared for this manœuvre, and will apparently recover simply by centralizing the controls. No incipient spin was apparent in the stalls.

For landing, the undercarriage can be selected down below 124 m.p.h., and the infinitely variable flap extended to its first stage below 112 m.p.h. Once again, little change of trim is apparent, and full flap can be lowered below 100 m.p.h. I found about 80 m.p.h. to be a comfortable approach speed, giving a fairly steep descent regulated by variations of about one-third power. Unlike its American contemporaries, the Falco is not underflapped, and can get in and out of more restricted airfields.

The Falco responds well to the normal tricycle technique of being motored on to the ground, and the landing is completely conventional. During its early tests, the aircraft survived being stalled on landing from 16 ft. or so above the ground, with impact loads of more than 5*g*.

There is no doubt that the Falco is one of the most exhilarating aircraft now available for personal flying, and represents a completely new concept for the average British private pilot. At £5,000, including U.K. import duty of 17½%, it may be a little expensive for the clubs as a trainer, but it has no competitor in its price and performance bracket as an aerobatic tourer.

LEADING PARTICULARS

DIMENSIONS.—Span, 26 ft. 3 in.; length, 21 ft. 4 in.; height 7 ft. 6 in.; wing area, 107.5 sq. ft.

WEIGHTS.—Empty, 1,124 lb.; oil, 13.6 lb.; fuel (front), 110 lb. (rear), 79 lb.; two persons, 308 lb.; baggage, 66 lb.; max. aerobatic, 1,653 lb.; max. gross, 1,719 lb.

PERFORMANCE.—Max. speed, 214 m.p.h.; max. cruise, 190 m.p.h.; economical cruise, 162 m.p.h.; initial climb at max. weight, 1,070 ft./min.; service ceiling, 19,000 ft.; range, with half-hour reserve, 700 miles; take-off run, 820 ft.; to clear 50 ft., 1,590 ft.; landing run, 754 ft.; from 50 ft., 1,345 ft.

A Story of Air Transport

AS the first serious attempt at a history of British Air Transport, "The Seven Skies"* ought to be an important book. Unfortunately, although it should certainly be read by everybody with any connection with air transport, it will probably disappoint readers who have made any study of aviation history—and particularly those in the airline business. As the present reviewer comes into both these categories, his reactions may be unreasonably critical!

Commissioned by B.O.A.C. to write the 40-year story of the Corporation and its predecessor airlines, Mr. Pudney has produced his customary polished professional author's job. "The Seven Skies" is both entertaining and easy to read. However, as the author explains in his foreword, he has written the book "as a layman without much specialized knowledge of civil aviation," and has "avoided technical details of engineering, equipment, or aviation operation, though there are some of these—aviation radio is one—which deserve a volume to themselves." This may be true—although one might observe in parentheses that there are more directly fundamental aspects of air transport than radio deserving of first attention—but the main trouble seems to be that the author has overplayed his declared amateur status.

Books of this type have little chance of being genuinely satisfying, at least to those knowledgeable or interested in their subject—which must, after all, be a majority of readers of this class of literature—unless they take account of the fundamental importance of technical factors. Books intended for the general reader obviously cannot discuss technical matters in detail. However, they certainly should avoid awkward, superficial or inconsequential treatment of major technical issues.

We are told inside the dust wrapper that the book has been carefully scrutinized for technical accuracy by B.O.A.C. The author also acknowledges his indebtedness to Captain W. Armstrong for his research and practical advice. Captain Armstrong has done his job well. Only one or two quite minor actual errors have crept through. One is very obvious: the Short Scipio flying-boats were *not* the first four-engined passenger aircraft in the World to be used by an airline. Almost certainly, this distinction belonged to the Farman Jabiru, which was operated by D.D.L. in 1926.

The story gets under way slowly, which is surprising because, although air transport made but a modest start in 1919, there can be no lack of dramatic material about those early heroic days. Indeed, those first years of private enterprise air transport were crowded with incident, as much in the operational sense as in organizational changes and administrative and commercial problems. Also, aviation certainly attracted at least as many unusual and colourful personalities then as it has ever done since.

The best part of "The Seven Skies" is that which concerns the period of the late 1930s, immediately preceding the formation of B.O.A.C. out of the amalgamation of Imperial Airways and British Airways. Comment on the strictures of the Cadman Committee Report is well-informed and puts this whole unfortunate period into an easily grasped perspective.

Before this there is patchy coverage of the period from the mid-1920s to the mid-1930s. In parts it is very good indeed, and even inspires the reader to the hope that Mr. Pudney is about to lift his, as he modestly calls it, "portrait of the forty years' life of an airline" to the hoped-for truly historical level. However, except in places, it never quite makes the grade.

There is a satisfactory account of the problems of operating rights in Europe and the Middle East, which dogged Imperial Airways' expansion eastwards, but the picture of the even more important technical and operational developments and difficulties which governed, and delayed, progress is often unsatisfactory and incomplete. In particular, there is no comment or criticism, in the light of after events or on the basis of more recent experience, about such subjects as: the relatively slow development of ground facilities and bad-weather flying in Europe and on the Eastern and African routes; the obsolete British airliners of the later 1930s; composite aircraft, flight refuelling or flying-boats. Unfortunately, reasonably intelligent discussions of these matters amongst others really is essential to any useful historical perspective.

The historical narrative is in 10 chapters, and concludes with three which deal with B.O.A.C.'s activities during the Second World War and, finally, with a single chapter about the past 14 years. In view of the enormously increased size and importance of B.O.A.C. since 1946, it seems rather out of balance for this final third of the 40-year period to rate only one out of 10 chapters.

There is one chapter, "Of Machines," about the aircraft which have been used during the 40 years. This chapter suggests, perhaps more than any of the others, that where this book is particularly disappointing is in its failure to weave its colourful story round a straightforward account of technical, operational and economic development. If Mr. Pudney's skill as a writer could have been deployed on a broader front by providing him with additional specialist advice—so that he could have explained some of the more significant factors behind his historical "portrait" in layman's terms—how much more worth while this book might have been!—PETER W. BROOKS.

* "The Seven Skies," by John Pudney. Published by Putnam and Co., Ltd., 320 pp. Price 30s.

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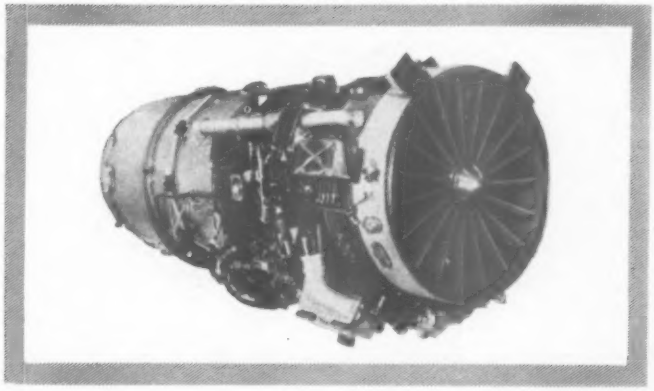
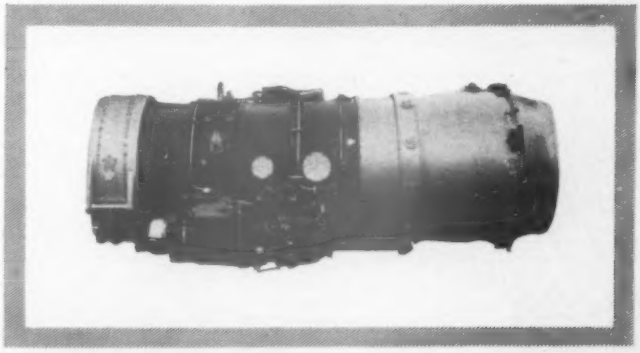


Conway by-pass jets for civil use will enter service in 1960 at 17,500 lb. guaranteed minimum thrust. The Civil Conway is being developed to powers over 20,000 lb. thrust with improved fuel consumption.

The RB. 141 family of by-pass jets (10,000 lb. to 17,500 lb. thrust) have been designed to give the best possible operating economics for jet transport aircraft. The RB.141 of 14,300 lb. thrust will power later versions of the Sud-Aviation Caravelle and the RB.163 of 10,100 lb. thrust has been chosen to power the Airco DH.121.



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Missiles and Astronautics . . . .

Soviet Space Boosters

KENNETH GATLAND *surveys the background to Russia's missile and space programmes.*

ALTHOUGH the Russians have released a good deal of information about the Sputniks and their findings, we still know remarkably little about the vehicles that launched them, nor do we have any information about the booster stages of the Lunik moon-probes.

It is not difficult to understand why this deficiency exists. The rockets the Russians use are obtained from the military programme, and it has never been Soviet policy to issue "handouts" on weapons. Thus, although it is possible to obtain the most revealing glimpses of American rocketry from perusal of the Technical Press, there is a complete dearth of information on the Russian side.

Despite the fact that Russian authors have written extensively about their country's satellites and probes, and the theory of space-flight generally, unclassified books on rocket engineering are virtually unknown and the student must rely on publications the State Publishing Houses obtain from Western sources which, in translated form, are widely distributed throughout Russia and the satellite countries. In this way, many well-known American and British technical books on missiles and astronautics have been made available to the Communist World. Books are published without fee, or even the consent of the author.

The only known occasion on which Soviet-built missiles have been shown in public was on November 7, 1957, during a parade through Red Square commemorating the 40th Anniversary of the Bolshevik Revolution, the weapons being roughly equivalent to the American missiles Nike Ajax, Honest John, Corporal and Redstone. This last, clearly an early post-War development of the German V-2, was fitted with four aerodynamic fins and rudders and had four refractory exhaust vanes. Assuming a similar payload to that of the V-2 (2,150 lb.), the range could not have exceeded 500 to 600 miles.

This was obviously one of the rockets German scientists helped the Russians to develop immediately after the War after numbers of specialists from Peenemünde and elsewhere had been captured by the Red Army and "encouraged" to work in Russia. The Germans are also believed to have assisted in the development of an improved V-2 rocket engine, the so-called Type 103 of 35 metric tons (77,000 lb.) thrust, mainly by increasing the rate of propellent flow.

This information was first revealed by George Sutton of N.A.A. Rocketdyne in 1953. The subsequent appearance of the improved V-2 in Red Square bears out the accuracy of Sutton's seven-year-old information, obtained from an undisclosed German source. At the same time, a much larger engine of 120 metric tons thrust (with a chamber pressure of 60 atmospheres, 880 p.s.i.) had been mentioned, this, too, from information reaching Sutton from Germany.

German Specialists in Russia

What little reliable information there is of Soviet rocket development has come from German engineers who worked in Russia after the War; but even this source does not prove as helpful as one might suppose. The Germans appear to have been used to solve certain fundamental problems on rocketry rather than work on specific projects.

One of the leading ex-Peenemünde rocket engineers taken to Russia after the War was Helmut Gröttrup who, at first, was put in charge of the reconstruction and testing of captured V-2 rockets. The background to his seven years' activities behind the Iron Curtain are given in a fascinating book recently published* which, in addition to giving an insight into the hardships endured by the abducted families, provides some interesting tit-bits of technical information.

The book gives the date of the first V-2 test-firing in Russia as October 30, 1947. Launched from a site on the steppes of Kazakhstan, some 12 miles east of Stalingrad, the rocket is said to have travelled 185 miles and to have impacted in the specified target area. A second firing 13 days later was less successful, a control fault causing the vehicle to "reel drunkenly in the air" and crash.

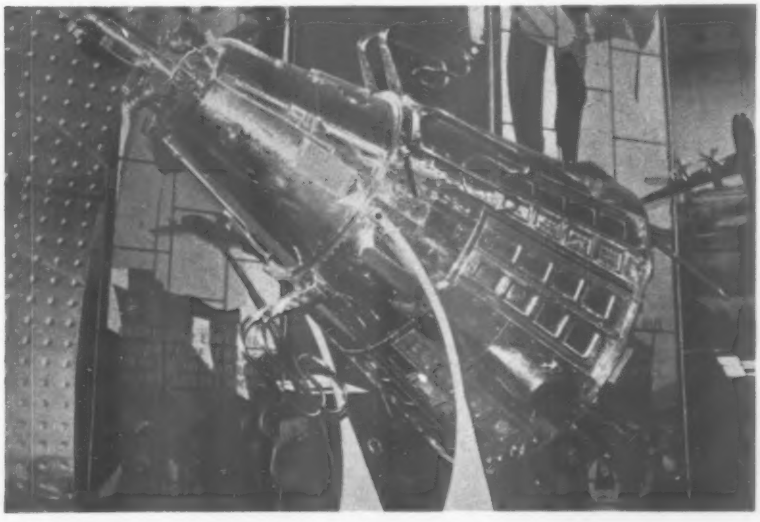
A total of about 200 German rocket specialists were sent to Russia but not all were put to work in one place. Gröttrup's people were established in a near-derelict factory in a Moscow suburb which had once been used for the manufacture of drilling machinery.

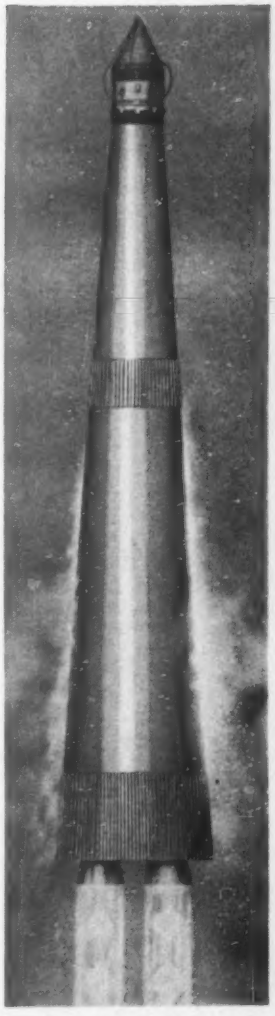
In December, 1947, Gröttrup put before the Soviet Scientific Council a new project with the intention of extending the range and altitude of the V-2 in a new, simplified, design. The rocket would have a range of 550 miles, and calculations were made on the basis of 25% of the missiles hitting a target area one kilometre square. The Germans proposed guiding the rocket "over a certain distance by means of a fixed radio beam," also to separate the warhead in flight.

At the meeting of the Scientific Council, Gröttrup learnt that the Russians had a similar project of their own, but it seems that many features of the German design were embodied. At the time, there were complaints on the German side "that the German management of the Collective were not given any insight into the general policy and the future development of the work."

In the late Spring of 1948, the entire German group was transferred to an island in Seliger Lake, near the source of the Volga. There, it is reported, the work continued with the Russians using the German specialists to develop ideas which they then proceeded to incorporate in their own designs at some other

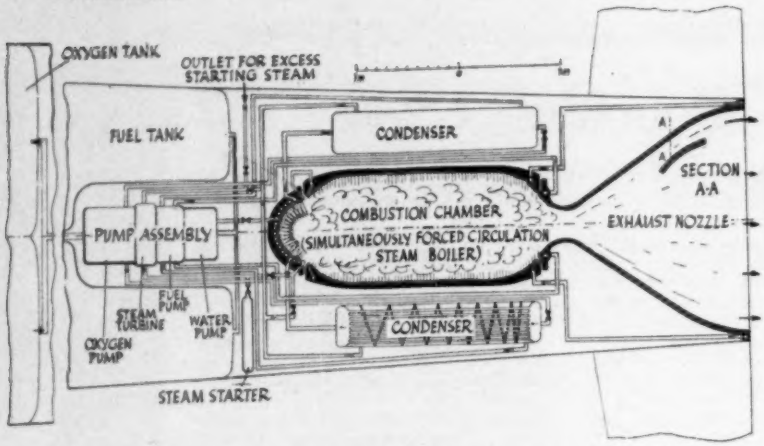
* "Rocket Wife." by Irmgard Gröttrup (translated by Susi Hughes). Published by Andre Deutsch, 16s.





SPACE VEHICLES.—Sputnik 3, (left) in orbit since May, 1958, is similar in size to the manned Mercury satellite under development in the U.S. The artist's impression above represents the type of missile Russia may have used to launch her Lunik moon probes.

Howard Levy photograph



GERMAN POWERPLANT.—When German rocket engineers went to Russia after the War the U.S.S.R. gained useful information on such projects as the Sänger-Bredt antipodal bomber for which this propulsion system was planned.

centre. In January, 1949, ". . . all they had done was quite coolly to incorporate the controls, removable nose and exhaust mechanism from the German model." This particular rocket was apparently the largest example of three tactical missiles paraded through Red Square in November, 1957, and incidentally admirably confirms Sutton's information.

By April, 1949, discussions were taking place at the island research centre concerning a rocket of 1,800 to 2,000 miles range to carry a 3-ton payload. Of 10 projects under consideration at this time, some were said to be for rockets of two and three stages. A great deal of thought was given to the problem of producing a single-stage rocket of this range.

The idea of a conical rocket body was advanced by Gröttrup in July, 1949, and a Soviet technical commission approved the start of project work on a single-stage "conical rocket" with pressure stabilized tanks—the R-14—on October 22, 1949.

While Soviet engineers arrived at the island research centre in increasing numbers, German influence in technical matters seems to have begun to diminish. Frau Gröttrup says her husband was not invited to attend the Scientific Council which discussed the project in Moscow the following March, although the Germans were still expected to work out "details of construction." They would not, however, take part in the rocket's physical development or test.

Technical details of the R-14, as originally conceived by the German group, are: launching weight, 73 tons; empty weight, including 3-ton payload, 7 tons; thrust, 100 tons; combustion chamber pressure, 60 atmospheres; cut-off velocity, 9,900 m.p.h.; cut-off altitude, above 60 miles. Note how closely the thrust and chamber pressure of the engine agree with Sutton's earlier figures!

The conical rocket embodied an engine which was gimbal-mounted, with both gyro and radio guidance systems. After cut-off of propulsion, the payload was to be separated from the rocket body and nose cone by the detonation of two circular charges. On the descending path of the trajectory, the detached nose cone and rocket body would be burnt up in the atmosphere, while the payload, which was protected by thick walls, reached the ground.

July, 1952, and Frau Gröttrup writes that "the Russian engineers are already working out details on their own, even in our Institute, and only bringing our men into it to sound them out on how this or that could be improved," and in October, "we never hear anything now about the Russian rocket programme. . . ."

It seems Gröttrup and his fellow Germans never knew the outcome of their labours. While some of their number were repatriated, Gröttrup was asked to develop an electronic computer, and finally, in November, 1953, he and his family were also returned to Germany.

Missile Tracking

What little gleanings we have of Soviet post-War rocket development has come from three main sources: (1) repatriated German engineers and Soviet technicians who defected to the West; (2) tracking of Soviet missiles during test-firings from U.S. radar stations in territories bordering Russia; and (3) calculations based on the payloads of the Sputniks.

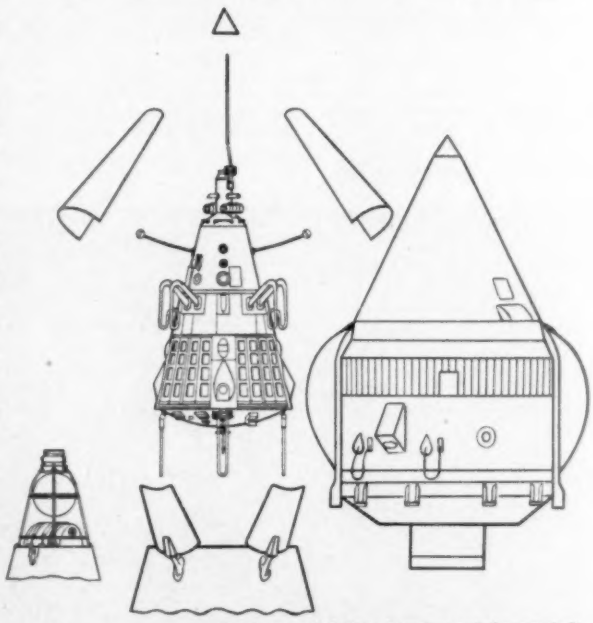
In addition, a certain amount of background information has been forthcoming from the Soviet Press and published lectures (e.g., upper atmosphere research with rockets, experiments with dogs carried in high-altitude rockets and recovered by parachute; calculations of probe trajectories, etc.). While throwing no light on Russia's heavyweight missiles, these do serve to indicate the general trend of Soviet ambitions.

To achieve their distant objectives ballistic missiles rise hundreds of miles and their telemetery signals (carrying experimental data to ground receiving stations), detectable at long range, have proved valuable in the plotting of trajectories. Test firings of Russian ballistic missiles have been detected by American radar stations in Turkey. These techniques are believed to have given the West a reasonably accurate picture of Soviet missile testing, with a fair judgment of ranges achieved.

The Sputniks

What of the Sputniks? Looking back it is indeed hard to believe that, following the successful orbiting of Sputnik 1 on October 4, 1957, delegates who attended the I.A.F. Congress in Barcelona the following week had suggested to Russian scientists that "possibly a decimal point has slipped" and the true weight of their satellite, as given by Tass, might be 8.36 kg. instead of 83.6 kg. (18.4 lb. as against 184 lb.). After all, we had been expecting the first satellite to be America's Vanguard and although that had approximately the same diameter, its proposed gross weight was only 21.5 lb.

At a time when American scientists were performing miracles in the miniaturization of instruments, radio and power supplies to enable the 10-ton Vanguard 3-stage rocket to orbit a useful payload, the Russians—seemingly without effort—had tossed a 184-lb. Sputnik into orbit. But little did we realize in October, 1957, that the next eight months would see two more Sputniks, one with a payload of 1,120 lb. (including a dog-passenger),



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RUSSIAN SATELLITES.—To the same scale are (left to right) Sputnik 2 and Sputnik 3, both Earth satellites, and the final stage of Lunik 1 which passed close to the Moon before going into orbit around the Sun.

Missiles and Astronautics

and the other a veritable orbiting laboratory weighing no less than 26 cwt.

How was all this achieved? First, it is evident that more than one basic vehicle was involved. At the I.A.F. Congress in 1957, a few days after Sputnik 1 was launched, H. H. Koelle (Chief, Preliminary Design Section, U.S. Army Ballistic Missile Agency, Huntsville, Alabama), suggested that the Russians were using the 264,000-lb.-thrust booster of their IRBM as the basic booster of a three-stage orbital carrier and the improved 77,000-lb.-thrust V-2 missile as the second stage.

This approach was attractive because it had the advantage of using proven hardware with established reliability. The job remaining to be done was to develop a third stage and to mate it properly with the two other stages.

Experimental testing of the basic two-stage IRBM is believed to have begun early in 1955 from a range facility at Krasny Yar, near Stalingrad. The missile is believed to have a range of 1,800 miles and, according to information circulating in Washington earlier this year, more than 1,000 of the type are now in operational service.

Confirmation that ballistic missiles are the basis of Russia's space-programme came in 1957 when Academician Prof. L. I. Sedov said that when rockets were needed for a space-project scientists merely applied to the military authorities. At the I.A.F. Congress in 1958 he gave the information that Sputniks 1 and 2 were launched by different vehicle types. "Soviet scientists," he said, "had three different rocket vehicles available for their scientific programmes. . . ."

Soviet ICBM

Maximum interest, of course, centres on the ICBM. On August 27, 1957, the Soviet news agency *Tass* announced the launching a few days before of "a super, long-range, intercontinental, multi-stage, ballistic rocket." The carefully guarded statement continued: "The flight of the rocket took place at a very great, hitherto unattainable, altitude. Covering an enormous distance in a short time, the rocket hit the assigned region. The solution of the problem of building intercontinental ballistic rockets will make it possible to reach remote regions without resorting to strategic aviation, which at the present time is vulnerable to modern means of anti-aircraft defence."

Clearly there was not much to be gleaned from that; but it did indicate that a certain advanced stage had been reached in Soviet missile development ahead of the United States. Moreover, the launching of Sputnik 3 on May 15, 1958, showed something of the payload capacity of this particular rocket which existing U.S. missiles could not hope to equal.

Even the spectacle on December 18, 1958, of an Atlas ICBM (less boost engines) putting its own 8,750-lb. structure into orbit, could not strictly atone; for what counts is the *effective payload* that can be placed in orbit—and in this case the payload amounted to only 150 lb. of radio equipment.

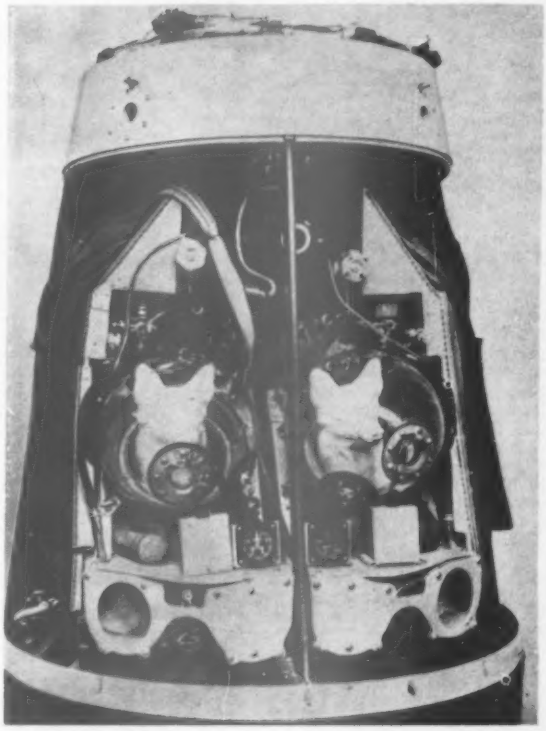
Sputnik 3, unlike its dog-carrying predecessor, did not remain attached to its carrier rocket. Conical in shape, it is 11 ft. 8 in. long with a base diameter of 5 ft. 8 in. It has a total weight of 2,919 lb. (including 2,113 lb. of research apparatus and radio equipment) and is still radiating signals.

Moreover, it was accompanied in orbit by its final-stage carrier rocket. Drawings of the release arrangement published in *Pravda* suggest that the rocket body must have exceeded 7 ft. diameter and optical measurements of the orbiting body indicated its length as approximately 70-80 ft. Until December 3, 1958, when it finally disintegrated in the atmosphere, the carrier rocket was an impressive sight over England when its tumbling motion caused the long cylindrical body to reflect sunlight unevenly, making it appear to "flash."

Clearly the vehicles that launched Sputnik 3 and Luniks I and II were very large step-rockets. Indeed, if one considers the present state of the art—small thermonuclear warheads/high megaton yield—these rockets, if used as ICBMs, would appear to exceed military requirements for point-to-point H-bomb delivery.

However, at the time of inception H-bombs were exceedingly cumbersome, and this provides us with a clue to a situation which finds a parallel in the history of the American ballistic programme. When Convair first considered the design of an ICBM in 1951, it was found that the vehicle would have to be a multi-stage rocket with a launching weight exceeding 200 tons. Seven engines of 125,000 lb. thrust were assigned to the first stage, and calculation showed that the whole battery would develop no less than 20 million horse-power at burn-out.

Faced with a project of this magnitude, a Pentagon missile survey committee in 1953 recommended cancellation on the grounds that "the design exceeded engineering experience." Even the most enthusiastic rocket engineers expressed doubts



TOP DOGS.—First indication of Russian rocket research making use of animals was the journey of dogs into the upper atmosphere; this display rocket shows a two-dog layout. In the U.S. the emphasis in live tests to date has been more on monkeys and mice as space travellers.

that the project could be a feasible engineering proposition within 10 years and, at that, it would be a fabulously expensive vehicle to produce, test and operate. Once built, it was doubtful whether the missile would be sufficiently accurate over the great distances demanded of it.

The break-through came in October, 1953, when American physicists reported the feasibility of a light-weight H-bomb, which immediately halved the rocket's launching weight without any compromise in performance (the original specification called for a Mach No. of 15, and a maximum range of 5,000 n. miles).

Instead of seven rocket engines, only three were now required. Moreover, the megaton-yield of the improved fusion-type warhead was so great that the missile's accuracy was much less critical; because if the warhead fell within a 20-mile circle, this was considered adequate for the destruction of the target.

In view of the American experience, the question might now be asked whether the Russians met the same initial difficulty in their ICBM programme but, unlike the Americans, did not wait for thermo-nuclear refinements but accepted the challenge of developing a "super-rocket." (Russia tested her prototype H-bomb on August 12, 1953.) If so, the all-up weight of this giant rocket could have been anything from 200 to 250 tons, with a payload capacity of probably more than five tons.

A multi-stage rocket of these proportions would have no difficulty in orbiting Sputnik 3, or of sending Lunik to the Moon. This basic vehicle may well spring more surprises in the not-too-distant future. It might be emphasized, for example, that the weight of Sputnik 3 already exceeds that of the Mercury space-capsule, for which test-observers are now being trained for a test-programme beginning in 1961.

Seven-year Space Plan

A statement by Dr. Alexander Nesmeyanov, President of the Soviet Academy of Sciences, earlier this year, provides confirmation that the Russians are making an all-out drive in space-research, not only to gather information by means of instruments, but to obtain direct experience with men. A seven-year plan to put Russian scientists on the Moon, Dr. Nesmeyanov announced, began in January.

If the Russians are really serious in this, it is doubtful whether any fundamental new propulsive technique is envisaged. Rather we may look to the clustering of high-thrust rocket engines using more-or-less conventional chemical propellents; over

Missiles and Astronautics

the past year there have been reports that a Soviet rocket engine of 800,000 lb. thrust has been developed.

At all events the award last year of a contract to North American Rocketdyne for a 1-1.5 million lb. s.t. rocket engine was believed to reflect American anxiety at Russia's progress with outsize propulsion units.

Man in Space

To have any chance of putting men on the Moon by 1966, it is evident that the first steps towards getting a man into orbit around the Earth must have already been taken.

However, despite the fact that the existing Soviet multi-stage rockets can easily loft a space-capsule into orbit, there is still no indication that such an experiment is imminent. For one thing, it is to be expected that attempts would first be made to send up a man in a ballistic rocket, but despite reports circulating in America that this had in fact been tried, Professor Sedov at the recently concluded 10th I.A.F. Congress said flatly that this was not the case.

Moreover, great play is being made among Russian scientists of the need for caution in experiments where men are involved. No firing involving men will be made until we are certain of success, they say.

Further comment on this theme was made recently by Professor V. Dobronronrovov writing in *Promyshlenno-Ekonomicheskaya Gazeta*, in which he states that two single-stage geophysical rockets launched in July were returned safely to Earth from high altitude using containers which were an improvement over earlier models. The first rocket carried two dogs and a rabbit and the second two dogs.

However, he says, the use of parachute re-entry methods alone, as was the case in certain Soviet geophysical rockets, will not suffice to return a satellite, "especially one containing a man." "We need a satellite which can also be a unique type of glider—one that has devices to prevent the rocket from revolving around its horizontal and vertical axes."

This prospect of using satellite glide vehicles crops up time and again in Soviet technical literature. For example, Professor G. V. Petrovich, writing in *Vestnik Akademii Nauk*, June, 1958, says: "All units and instruments ensuring the functioning of the human organism in flight must work absolutely faultlessly. The return of man to Earth should be made by rational use of the air drag.

"Evidently a gliding descent will be the principal means of landing astronauts not only on Earth but also on other planets possessing a sufficiently dense atmosphere. Gliders of minimal weight for landing the crew on the surface of a planet will be a necessary fixture on many spaceships and stations outside the Earth."

Even Frau Gröttrup in her book mentions Russian interest in a new kind of rocket glider in a diary paragraph dated May 1, 1953.

In fact, the idea of hypersonic glide vehicles dates back much further than this. In his book "Stalin Means War," published in 1951, Col. G. A. Tokaev tells of Stalin's personal interest in long-range guided-missiles, in particular the Sänger-Bredt proposals for a hypersonic rocket-propelled bomber. Tokaev (formerly chief of the aerodynamics laboratory of the Military Air Academy in Moscow) defected to the West from the Soviet Zone of Germany in 1948.

It is, of course, pure speculation, but it could be that Russia has elected to ignore the non-lifting manned re-entry capsule and instead has gone straight for a lifting vehicle with a measure of aerodynamic control. In this case, the United States, still uncommitted on the design of the Dyna-Soar, could again run a rather poor second to the Soviet Union.

Minuteman Details

INFORMATION about the configuration of the Minuteman ICBM has been published recently in America. This solid-propellent missile will be about 55 ft. long and will have three stages. The first stage, about 25 ft. long and 5 ft. in diameter, will be the largest single solid-propellent grain ever produced; it will exhaust through four nozzles each about 15 in. in diameter.

Explosion techniques will be used for stage separation, possibly by means of shaped charges inside structural fairings between the stages. The guidance and control system will be mounted in the top stage just behind the nose cone.

Studies of the deterioration of solid propellents suggest that Minuteman can be left for up to three years in underground "silos" ready for push-button launching. Test silos for the missile are being built at Edwards AFB in California; they are 83 ft. deep and 26 ft. in diameter.

Plans call for mobile deployment of Minuteman as well as its launching from hard underground sites. Missiles will be mounted on motor trucks and on special rail flat-cars so that they can be moved about. This should prevent an enemy from pin-pointing missile sites and will add to the deterrent value of Minuteman.

According to a U.S.A.F. source their new missile will complement rather than replace the Atlas and Titan ICBMs. Minuteman has a considerably smaller warhead than the earlier missiles and could be used to attack point targets, while Atlas and Titan are intended to obliterate much larger areas.

Moon Landing Problems

THE Lunar and Planetary Exploration Colloquium meets informally in the U.S. for periodic discussion of the scientific and engineering aspects of lunar and planetary exploration. The Colloquium's objectives include the bringing together of scientific and engineering personnel for the exchange of space information; defining the scientific value of lunar and planetary exploration; investigation of experimental methods and instrumentation for achieving the desired results; providing a means for long-term appraisal of the entire space picture; and making available nationally the collective thinking of a specialized group on the subject—all without disclosing classified military information. It is not intended to replace any other organization or to impinge on the prerogatives of any agency or group, governmental or otherwise.

Numerous schemes have been proposed for landing vehicles on the surface of the Moon, a procedure which presents a problem because of the lack of atmosphere and the nature of the lunar surface. The difficulty of making a successful landing has been compared with that of a landing by helicopter in the Grand Canyon, at night, by remote control.

One method of landing a small instrument carrier was suggested by the Rand Corporation. It uses a spin-stabilized missile with an integral solid-propellant retro-rocket and a landing spike, which penetrates the surface to a depth depending on its hardness.

In order to cater for the case where a spiked vehicle strikes the surface in otner than a "head-on" angle, Krafft Ehricke of Convair has suggested a ball configuration. Here the payload is surrounded by a shock-absorbing structure which has a low coefficient of restitution. Thus, upon impact the sphere would bounce slightly or roll until it came to rest.

Limiting the landing velocity to about 30 ft./sec. permits the use of a more sophisticated vehicle having a landing gear with wide-spread legs and ample travel so as not to damage sensitive equipment. Also, if this vehicle is landed in a predetermined attitude, there is an obvious advantage in the design and installation of research equipment and such systems as temperature control, solar power and data transmission. Several agencies in the U.S. are studying this problem.

Ending the Vanguard Programme

ON September 18 the first satellite programme ever announced came to an end when Vanguard 3 was successfully launched into orbit from Cape Canaveral. Eleven launching attempts were made in the Vanguard series, but of these eight were failures. On the other hand, when successful, the satellites have been launched into long-life orbits; Vanguard 1, the famous "grapefruit" satellite, is expected to remain in orbit for up to 1,000 years, while the larger Vanguards 2 and 3 are expected to stay up for about 10 and 30-40 years respectively.

In July, 1955, following suggestions that satellites should be launched in connection with the International Geophysical Year, President Eisenhower announced that a $10m. programme of research and construction was to begin. Russia immediately announced that she also would launch satellites and in fact both Sputniks 1 and 2 were in orbit before the first unsuccessful Vanguard attempt was made in December, 1957.

Another abortive attempt was made before Vanguard 1 was launched in March, 1958. Four more failures followed before Vanguard 2 was put into orbit in February, 1959. Between this success and the final successful launch came two more abortive attempts.

A detailed account of the background to the Vanguard programme—specially written for us by Mr. James Strong—was published in THE AEROPLANE of June 28, 1957, several months before the current "satellite age" became a reality.

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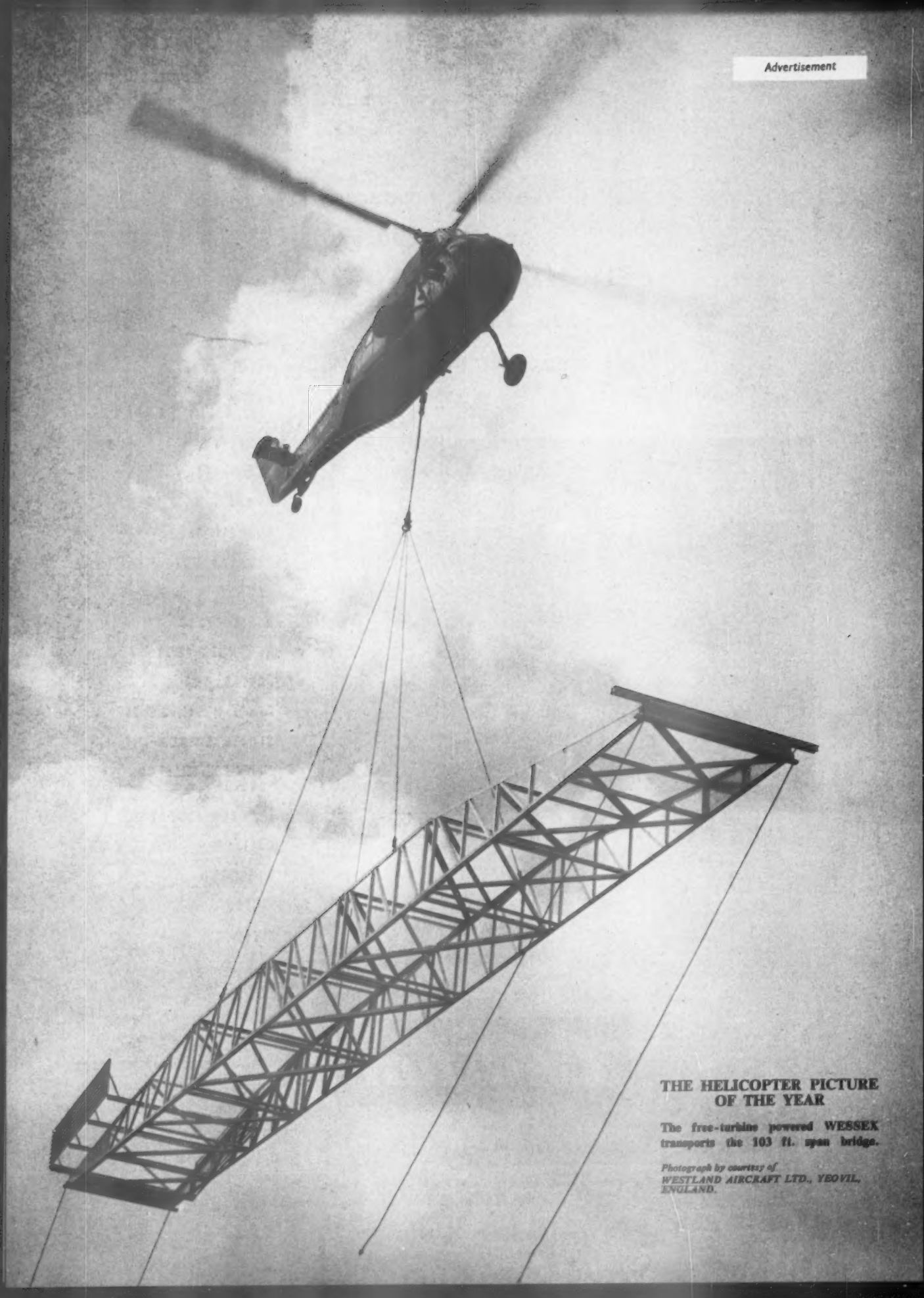

THE HELICOPTER PICTURE OF THE YEAR

The free-turbine powered WESSEX transports the 103 ft. span bridge.

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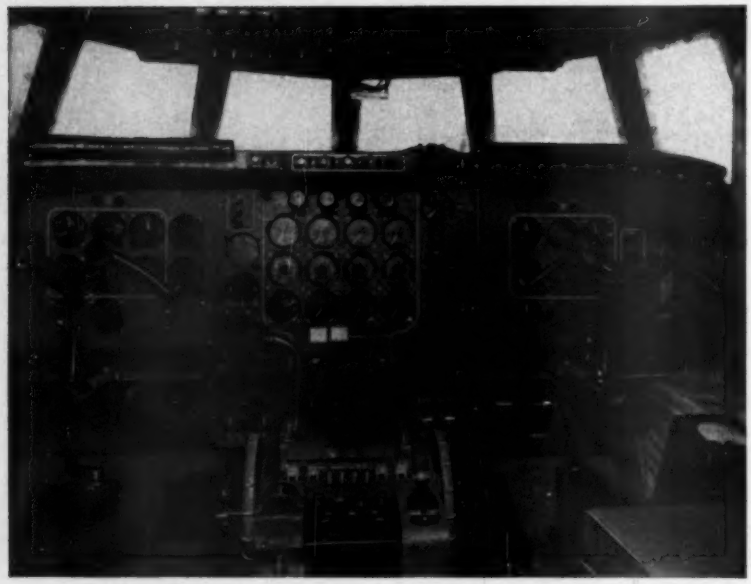

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Lunar Probe Launchings

by S. W. Greenwood, B.Sc., M.Eng., A.M.I.Mech.E., A.F.R.Ae.S.

IN this note, attention is concentrated on the mechanics of the problem involved in launching a Moon probe. What are the factors affecting the selection of favourable times for such launchings?

A look at Fig. 1 will remind the reader of the essentials of the relationship between Earth and Moon and Sun. The Moon rotates around the Earth in a roughly circular path, and the Earth rotates in a roughly circular path around the Sun. One complete rotation of the Moon around the Earth takes about 28 days, so that the interval between the successive phases shown in the figure is about seven days. The period of rotation of the Moon about its own axis is the same as that of its rotation around the Earth so that, apart from small variations, the same area of its surface always faces the Earth.

Can the launching of lunar probes be associated with the phases of the Moon? It seems that there are reasons why there will often be a link between the two.

Fig. 2 shows that the transit times for crossing the space between the Earth and the Moon can vary from as much as five days to as little as a few hours, depending on the initial velocity imparted to the probe at cut-off of propellants outside the Earth's atmosphere. The guidance problem is difficult for the longer journeys, and for practical reasons the shorter journeys may be preferred.

However, the increased energy requirement for journeys taking, say, 1¼ days, is small, and it would be desirable to use a vehicle having a velocity capability slightly in excess of the minimum required, as the penalty for falling short when close to the minimum energy orbit could result in the failure of the probe. All the three probes fired to date that have reached the Moon's orbit have taken about 1½ days on the journey.

Should it be an intention that a probe is to miss the Moon and continue into space on an orbit that will be of value in exploring the solar system, then it is desirable to enter an elliptic path that will carry it as far away from the Sun as possible for a given available vehicle performance, or as close to the Sun as possible. As shown in Ref. 2, the initial vehicle velocity for such orbits varies from about 7 to about 10 miles/sec., depending on the distance to be covered. Reference to Fig. 2 indicates that the time taken to pass from the Earth to the Moon's orbit at the beginning of these missions will be from about 1¼ days down to about eight hours.

Where do we want the Moon to be when the probe arrives at its orbit? Fig. 1 suggests some answers.

A vehicle launched just before the Moon is New, when the shadow side faces the Earth, can be arranged to arrive when the Moon is New. What would be the advantages of doing this?

The vehicle will travel in the direction of the Sun's gravitational attraction, and this will confer a slight benefit from the point of view of performance. Impacts on the surface would take place in darkness and this could be advantageous in carrying out experiments involving light contrasts. Probes for entry into an orbit around the Moon would observe in sunlight the face not seen from the Earth. Observational data may then be stored for subsequent transmission to Earth when the probe emerges from behind the obscuring body.

When the Moon is at its opposite station, and is Full, the entire side facing the Earth is illuminated. This has obvious points in favour of the observation of vehicles intended for landing or impact, and also in the availability of immediate power supply when dependent on solar power.

Should the intention be that of missing the Moon and entering a reconnaissance orbit for exploring interplanetary space,

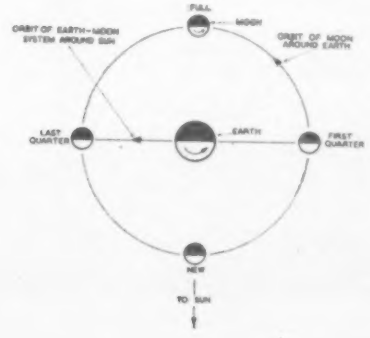

Fig. 1. Earth/Moon/Sun relationship.

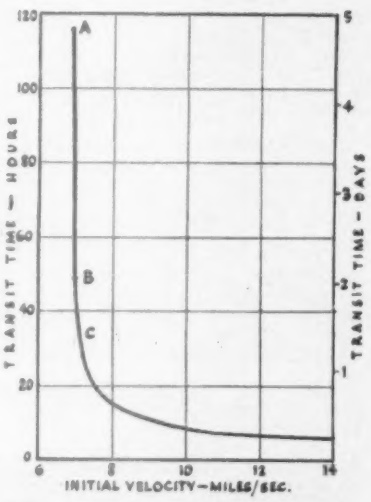

Fig. 2. Adapted from Ref. 1. (The influence of the Moon's gravitational field is ignored). (A) Journey by elliptic orbit with apogee touching orbit of Moon; (B) Journey by parabolic ("escape") orbit; (C) Lunik I, Pioneer IV and Lunik II.

advantage may be taken during flight of obtaining data on conditions near the Moon as it is passed by crossing the Moon's orbit near Last Quarter, for subsequent journeys outside the Earth's orbit, or near First Quarter, for subsequent journeys inside the Earth's orbit.

How do the firings to date fit in with these considerations? The information presented from Ref. 3 in the table below is intended to assist in deciding on whether a systematic answer can be given to this question.

PROBE	ORIGIN	LAUNCH	INTENTION	REALIZATION
UNNAMED	U.S.A.	2 days after new Moon	Orbit round Moon	Early failure
PIONEER I	U.S.A.	1 day before new Moon	Orbit round Moon	Went ¼ way and fell back
PIONEER II	U.S.A.	3 days before new Moon	Orbit round Moon	Early failure
PIONEER III	U.S.A.	2 days after last quarter	Pass Moon	Went ¼ way and fell back
LUNIK I	U.S.S.R.	At last quarter	Pass (or hit!) Moon	Passed near Moon
PIONEER IV	U.S.A.	1 day after last quarter	Pass Moon	Passed Moon
LUNIK II	U.S.S.R.	3 days after first quarter	Hit Moon	Hit Moon

It will be seen that the first three attempts to enter an orbit around the Moon were made when the Moon was near New. This confirms the proposed advantages of viewing the rear side while illuminated by the Sun. The next three probes were intended to pass the Moon and enter an orbit around the Sun (though there is considerable reason to doubt that Lunik I was not intended to impact the Moon) and the fact that they were fired near Last Quarter substantiates the suggestion that this permits entry into a suitable orbit around the Sun.

It may be significant that the final probe in the list, Lunik II, fails to conform to preconceived ideas. Launched when the Moon was approximately half-way between First Quarter and Full, it may indeed be true that the primary consideration affecting the timing was political rather than scientific. On the other hand, if there is a strong conviction that the Moon will be struck by the probe, and the objective is the determination of conditions in space as the target is approached rather than conditions on the Moon itself, then the timing would seem to be subject to few restrictions. Perhaps the second Russian probe was launched against such a background.

It is too early to consider the significance of the probe launched on October 4. This took place two days after New Moon, and the probe is expected to take about three days on its journey to beyond the Moon's orbit. It will then attempt to obtain data on the rear face, which will be largely sunlit.

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3. "Record of all known Space-Vehicle Launches," THE AEROPLANE AND ASTRONAUTICS, August 28, 1959.

General Aviation News

59 BOEING 707s.—As at September 18, the 54 Boeing 707s in service with five airlines had logged approximately 56,500 hours and carried about 960,000 passengers. A delivery had been made of a 707-123 during that week to American Airlines, which now has 20. A total of 59 707s had been delivered by mid-September.

P.531 DELIVERY.—Saunders-Roe has delivered the first of the pre-production P.531 helicopters to the Royal Navy. This version is powered by a Blackburn Turmo turbine engine and three are to be used by the R.N. for evaluation trials.

JETSTAR FLIGHT SYSTEM.—Lockheed has placed orders totalling approximately $1 million with Collins Radio for communication/navigation equipment to be installed in the JetStar. The first 25 JetStars will be completely equipped with Collins communication/navigation systems including the FD-105 Integrated Flight System.

INDONESIAN GANNETS.—First photograph of Gannet AS. Mk. 4s for the Indonesian Navy; they are reconditioned ex-R.N. aircraft with new Double Mamba engines. Indonesia has ordered 18 Gannets including two T. Mk. 5s.

BUAER ADVISORY BOARD.—The U.S. Navy's Bureau of Aeronautics (BuAer) has set up a standing BuAer-Industry advisory board on reliability and operational design requirements of aeronautical material. The board—under the chairmanship of Rear Admiral L. D. Coates, U.S.N., assistant chief for research and development—has been formed to "funnel" advice and recommendations from industry and BuAer field activities to the chief of the Bureau.

RESURGENT INDUSTRY. — The West German economics ministry is reported to have drafted a bill to allow for the manufacture of a German medium-range aircraft. Two designs have been chosen for development from the 13 submitted and the ministry suggests that 60 million marks—about £5 million—should be provided for their development.

FORGED, NOT CAST.—In our issue for September 18 an impeller exhibited by High Duty Alloys at the S.B.A.C. show was described as being a gravity die casting. The unit displayed—and illustrated—was, of course, a forging.

SAILPLANE REGATTA. — Nineteen Schweizer 1-26 "one-design" sailplanes from eight American States and Canada at the recent regatta at Elmira.

Commercial Aviation Affairs

M.E.A./B.O.A.C.—No mutually acceptable new agreement has been reached between B.O.A.C. and Middle East Airlines (see last week's issue, p. 278) and the present arrangements will be continued, with the Corporation as a 49% shareholder in M.E.A. A joint working committee is to be formed to examine the possibilities of co-ordinating the development of services. Meanwhile, a further loan of £1,130,000 is to be made by B.O.A.C.

B.O.A.C. AEROBRIDGE.—By next January an Aerobridge will be in experimental use by B.O.A.C. at Idlewild, New York. The Aerobridge is a telescopic, mobile, height-adjustable, covered way between the pier-finger or terminal and the aircraft door. Its use will permit trickle loading—which will be an advantage when the big-capacity 707-436s come into service in the spring.

K.L.M.'s ELECTRAS.—The first of 12 Lockheed Electras for K.L.M. arrived at Schiphol Airport, Amsterdam, on September 29 after a non-stop flight from New York International, Idlewild, in 10 hr. 5 min. Three more Electras are due to be delivered to K.L.M. before the end of the year.

ANOTHER CARAVELLE.—S.A.S. has ordered another Caravelle, to make a total of 17, including four for lease to Swissair. The 17th S.A.S. Caravelle is to be delivered in January, 1961.

COMMERCIAL AIRCRAFT

THIRD annual edition of our Commercial Aircraft Number, to be published next week, will provide a unique reference source to the transport aircraft of Britain, America, Russia, Canada, France, the Netherlands, East Germany and Japan. Contents will include standardized specifications, performance curves, engineering details, 3-view drawings, order lists, photographs and text on 30 current types.

MORE COMPETITION. — American Airlines has been authorized by the C.A.B. to operate non-stop services between San Francisco and New York, in competition with United and T.W.A.

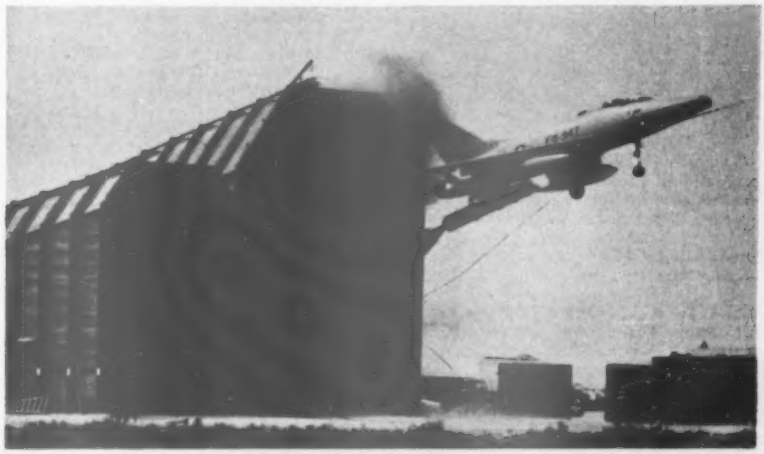
ATLANTIC INTERCONTINENTAL.—Pan American will introduce non-stop London-New York flights with Boeing 707-321s tomorrow, October 10. The scheduled times will be 7 hr. 35 min. westbound and 6 hr. 25 min. eastbound.

FIRST-HAND EXPERIENCE. — Those who read the recent announcement of BALPA's move to new offices at 81 New Road, Harlington, Middlesex, may not have appreciated the fact that this address is about 200 yards from L.A.P.'s runway 28R. As a writer in *The Log* remarks, after attending meetings in these offices, "I have been left in no doubt about the feelings of what might be considered to be a sympathetic part of the general public on the subject of aircraft noise. At certain times . . . all conversation has to be suspended. . . ."

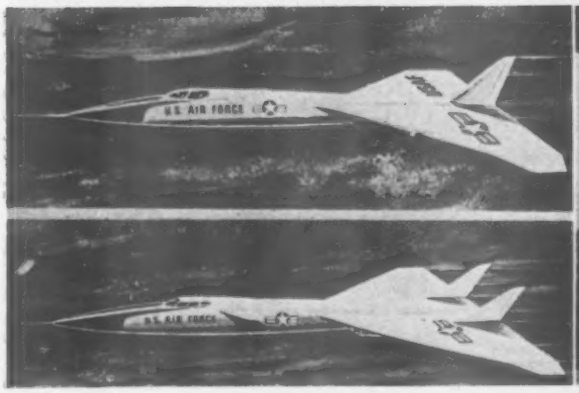
POPULAR VISCOUNTS.—Lufthansa figures for July and August show some very high load factors on Viscount 814 services. On the Munich-Frankfurt-London run, for instance, the averages were 82.3% and 80.3%, with 86.9% and 79.5% in the reverse direction; the London-Dusseldorf-Hamburg figures were 84.5% and 75.2%. Only two figures lower than 60% were recorded on 14 sectors.

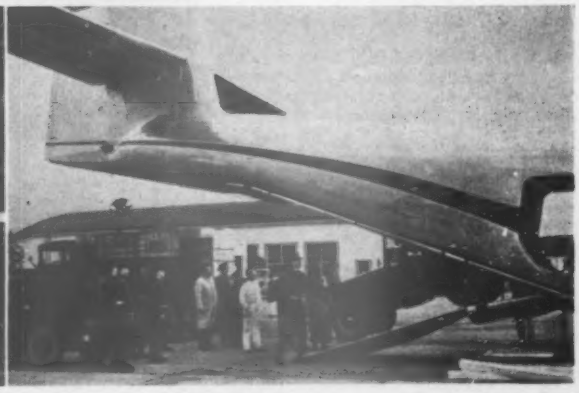
(*Continued on page 324*)

NEWS IN PICTURES



Top, a Super Sabre zero-launched at Nellis A.F.B. Above right, Tokyo's first heliport, the Seibu Air Station, on the roof of a department store. Above left, this production Omega BS-12D is for the Aero-Copters Division of Aero-Boeing. Left, an Alouette has been used to carry prefabricated sections for an Alpine refuge hut up to the assembly point at 10,000 ft. Below left, these artist's impressions show the North American F-108 fighter, recently cancelled, and the same company's Mach-3 bomber, the B-70 Valkyrie; development of the B-70 is continuing. Below, three de Havilland DHC-4 Caribous were to be delivered to the U.S. Army on October 8 for evaluation.





(*Continued from page 322*)

BIGGER HAMBURG.—The runways at Hamburg Airport are to be lengthened to 10,660 ft. and 11,800 ft. respectively from their present lengths of 4,815 ft. and 7,411 ft. The work, including that on new buildings, will be completed in 1962.

CARGO CONVERSIONS.—Air-India International has arranged for Lockheed Aircraft Services to convert three of its L-1049G Super Constellations to convertible cargo-passenger aircraft. They will be used to fly all-cargo services between Bombay and London, starting next year.

AIR JORDAN TO ROME.—During this month Air Jordan will inaugurate a non-stop Amman-Rome service with DC-4s connecting with the Pan American 707 flights to New York. "Flag" stops will be made at Jerusalem. Air Jordan is managed under contract by Transocean Air Lines.

NIGERIAN AIRPORT CONTRACT.—Taylor Woodrow (Nigeria), Ltd., has been awarded a £250,000 contract by the Nigerian Government for reconstruction work at Kano Airport. It is to be completed in eight months without interfering with aircraft using the main runway. Early next year the company is due to complete another contract valued at over £400,000 for resurfacing and extending runways at Ikeju Airport, Lagos.

TRAFFIC INCREASES.—During July the air transport movements at U.K. aerodromes increased by 3% on the figure for July, 1958, and passengers increased by 16% to 1,183,553. Freight, including vehicles, increased by 32% to 30,802 short tons. Ferryfield's in and out freight total was 15,434 and Southend's was 4,760 short tons.

BIGGER BOGOTA.—The new international airport at Bogotá will be opened in November. The 12,500-ft. main runway has already been completed.

A.A. APPOINTMENTS. — American Airlines has established a technical services division of the operations department. It is headed by Mr. F. C. Wiser as vice-president. Mr. W. B. Whitacre has been appointed vice-president, flight, with W. W. Braznell as assistant vice-president; both have had professional flying careers dating back into the 1920s.

EXCHANGE NEWS.—The latest Market Report of Aircraft Exchange Inc. lists more than 350 aircraft of some 75 different types and models by 16 different manufacturers. Membership now totals well over 300, including 95 airlines. In future, and until the activity of the market warrants an increase, the Market Report is to be published fortnightly instead of weekly.

LYDDA EXTENSION.—A new 8,860-ft. runway is being laid down at Lydda Airport, Israel, and a new terminal building is also planned.

NEW COMPANY.—To operate an air taxi business and provide tuition and maintenance services, Victoria Flying Services has been registered in British Columbia, Canada, by "Bill" Sylvester, former owner and founder of B.C. Air Lines.

BRANIFF LOSS.—On September 30 a Lockheed Electra of Braniff International Airways crashed in Texas while flying on the Houston-New York run, with the loss of 28 passengers and six crew members. The Electra appears to have disintegrated before impact.

News About People

MARCONI APPOINTMENT. — Dr. B. J. O'Kane has been appointed manager of the Marconi aeronautical division. He joined the company in 1952 as chief air radio engineer. Between 1935 and 1941

Dr. B. J. O'Kane

he was on the research staff of General Electric; in 1941 he went to T.R.E. at Malvern. After the War he returned to General Electric until 1947 when he became chief engineer of International Aeradio.

FLYING SCHOLARSHIP.—C. W. Callister has been awarded the first Robert Perfect Flying Scholarship, awarded by the Air League. The Scholarship, founded this year in memory of Mr. R. V. Perfect and to mark the Air League's Golden Jubilee, was awarded for the best essay on an aviation subject. It gives the holder a residential course of training to P.P.L. standard.

F.A.A. APPOINTMENT.—Mr. James L. Anast has been appointed Director of the F.A.A.'s Bureau of Research and Development. He was technical director of the Bureau's predecessor, the Airways Modernization Board, and has been concerned with aviation electronics since 1940.

EAGLE AWARDS.—For services to Italian tourism, Mr. Harold Bamberg of Eagle Airways was presented, on September 24, with a statuette by Senator Zanini, Deputy of the Rimini region of Parliament. Eagle operates a twice-weekly service to Rimini and has, in the past year, carried approximately 2,500 passengers on the route

MASTER PILOTS.—The G.A.P.A.N. has awarded Master Air Pilot Certificates to Capts. C. Halse, D.F.C. (Hunting-Clan African Airways), and D. R. Lawrence, D.F.C., and J. Whittell (both of Trans-Australia Airlines).

BELL PRESIDENT.—Mr. Harvey Gaylord, president of the Bell Helicopter Corp., has been appointed president of Bell Aircraft Corp. Mr. Leston Faneuf, Bell chairman and president since the death of the company's founder, Lawrence D. Bell, in 1956, will continue as chairman of the Bell board and executive committee.

BTR APPOINTMENTS. — As from October 1, Mr. P. W. Howard will cease to be managing director of BTR Industries, Ltd., but will remain a director and deputy chairman of the company. Dr. W. D. Scott, F.R.I.C., F.I.R.I., has been appointed to succeed Mr. Howard as managing director.

DEFENCE STAFF APPOINTMENTS.—Air Vice-Marshal A. Earle is to succeed Lt.-Gen. Sir Roderick McLeod as Deputy Chief of the Defence Staff in January of next year. Taking up his new post with the acting rank of Air Marshal, he became A.O.C., No. 13 Group, Fighter Command, in July, 1957.

R.A.F. STAFF COLLEGE.—Air Vice-Marshal M. L. Heath, C.B., O.B.E., is to become Commandant, R.A.F. Staff College, Bracknall, in November. He was previously Commander, British Forces Arabian Peninsula.

NEW W.R.A.F. COMMAND. — Gp. Off. J. A. Bannatyne has become C.O. of R.A.F. Spitalgate, thus becoming the second woman to command an R.A.F. station. Inspector of the W.R.A.F. for the past three months, Gp. Off. Bannatyne was previously at Headquarters, Technical Training Command.

R.A.F. TECHNICAL TRAINING.—Air Vice-Marshal W. H. Kyle, C.B., C.B.E., D.S.O., D.F.C., is to become A.O.C.-in-C., Technical Training Command, on September 21, with the acting rank of Air Marshal. Assistant Chief of the Air Staff (Operational Requirements) since September, 1957, A.V.M. Kyle was previously A.O.C., Malaya.

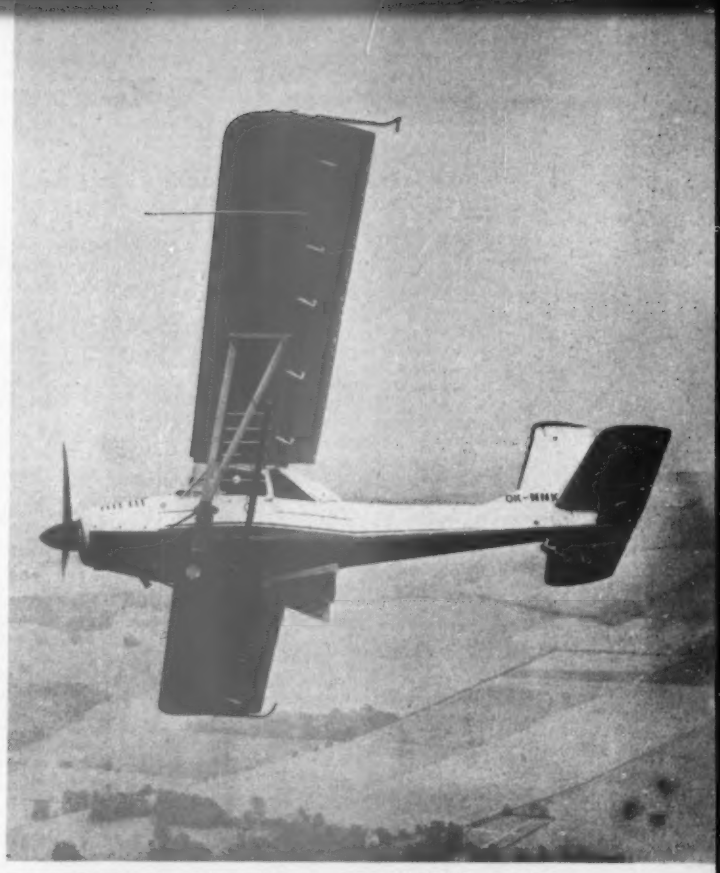
THUNDERBIRD INSPECTION.—A Swiss military guided weapons mission recently visited the English Electric factory at Stevenage. Left to right are Major H. Schild, Capt. A. Grossenbacker, Capt. W. Krebs, Mr. T. C. Mason (English Electric), Brig. R. V. Wattenwyl (leader of the mission) and Mr. R. V. Hurrell (English Electric).

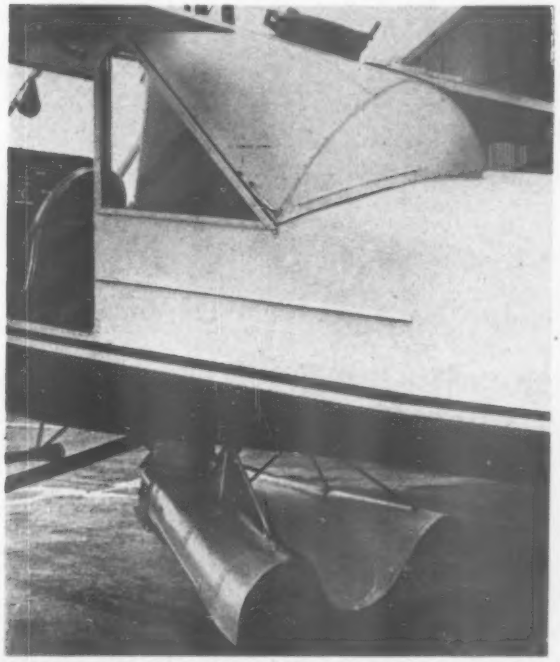
A Czech at Cranfield

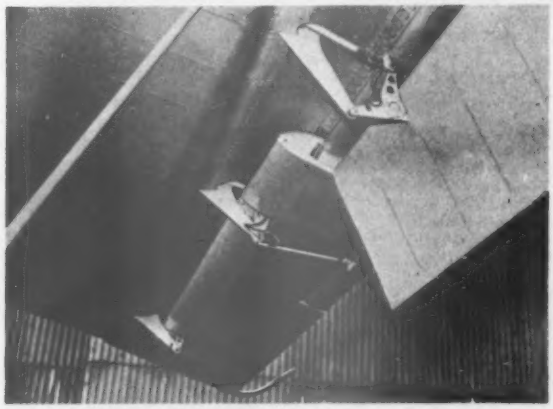
ONE of the most interesting visiting aircraft in the recent agricultural air display at Cranfield was the Czechoslovakian L60 Brigadyr. Making its first appearance in this country, the Brigadyr was flown from Prague in some eight hours' flying time, via Frankfurt and Brussels. The slow cruising speed of about 80 m.p.h. was due partly to the installation of both spraying and dusting gear, to transport them for demonstration.

An all-metal replacement for the Fieseler Storch, the Brigadyr is powered by a 220 b.h.p. Praga Doris M-208B flat-six engine. It has electrically-operated double-slotted flaps and full-span slats plus drooping ailerons (illustrated below).

The Brigadyr is being offered for sale in this country through the agency of Gp. Capt. E. L. Mole, for a duty-paid price of £5,350. A flight assessment appeared in our issue of October 10, 1958.







Here, the Brigadyr is shown carrying for ferry purposes both spraying booms and dusting equipment — these are normally alternatives. The spraybars are for water-based chemicals, while the wing-tip and under-tail nozzles are for oil-based insecticides. The rear-cabin tank carries nearly 100 gal. of liquids or solids, with a loading hatch above the opening aft-canopy fairing. The Brigadyr takes-off and lands to and from 50 ft. in little more than 200 yd.

Photographs copyright "The Aeroplane and Astronautics"

Personal Flying

During the summer season there are upwards of 550 air transport movements every day at the various Channel airports. All this goes on below the levels used by the longer-haul U.K.-Continent traffic, and the operators concerned have so far been left to their own devices.

These devices have resulted in the development of an agreed, but unofficial, Decca-flown airways system which, at some slight cost in flying-time for all the operators, works very well. The M.T.C.A. has quite enough on its hands in other areas and does not want to be involved in the expensive business of staffing and running this airways and control system.

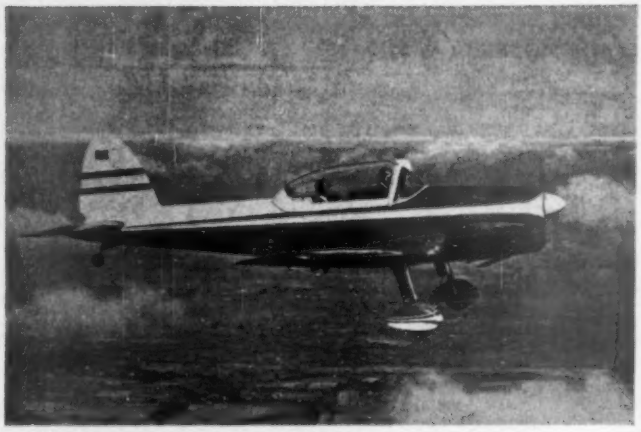
But there is a problem—and that is the unequipped private traffic in the area, and, particularly, around Lympne and Lydd. The airport operators like to have this traffic, but there have apparently been one or two crises and at least one occasion when the airline aircraft were temporarily grounded in bad weather because a "pirate" was known to be in the area and could not be given instructions.

It is possible that the Ministry will feel constrained to bring this free-enterprise airway system into the mandatory pattern. This will presumably mean that unequipped private aircraft will be denied the use of one or all of the airports in the area —and will, at the best, be restricted to clear-cut VMC conditions.

Before this happens could not some plan be devised to ensure the safety of the all-important fare-paying passengers without removing the freedom of the amateurs? There will certainly be no point at all in raising a loud squawk *after* official airways and control zones have been established.

• • •

Will single-seaters sell? This is a question which has been argued for almost as long as the legendary time since A.R.B. refused Icarus a Permit-to-Fly. Thinking back, over the rather shorter period of practical flight, it is certainly difficult to recall any single-seater which has sold in comparable numbers to "basic" two-seaters, such as Moths, Cubs and the like.



This elegant Chipmunk conversion has been done by Bristol Aircraft Ltd. for the Airways Aero Association.

Low-price designs in the category of the original "razor-back" Aeronca more than doubled their appeal when they were converted to carry two people instead of one, on little additional horse-power, and this lesson appears to remain true today. It may not necessarily apply to home-built types, as is shown by the number of Jodel and Turbulent single-seaters flying on the Continent and elsewhere. But, broadly speaking, the cheapest two-seater light aeroplane in production today costs twice as much as the cheapest single-seater, largely because of the bigger and disproportionately more expensive engine which is necessary.

One of the main reasons for the increased cost is that in moving from, say, the 40 b.h.p. power bracket up to 65 b.h.p., to cope with the heavier load, a change is almost inevitably made from a mass-produced automobile engine to a virtually hand-built aircraft powerplant. So, although the extra space of the two-seater is very desirable, even when it is not required to accommodate another person, its cost at the moment is excessively high.

Gliding Notes

by Dr. A. E. Slater

THIS year's Danish Gliding Championships were the best yet, Per Weishaupt writes, with over 6,000 miles of cross-countries in 489 contest flights totalling 331 hours. There were fewer launches than last time, and this, paradoxically, also shows an improvement, because it means that more people got away on their first attempt.

For once, all four previous champions competed, but none reached the top, and the highest placed among them, Jörgen Friis, shared a two-seater with someone else. The seven two-seaters and 10 single-seaters which took part were a miscellaneous collection, but the type which took the first two places was the German two-seater Ka-7, known as Rhönadler, designed by Rudolf Kaiser.

The contest was held at Vandel in Jutland. The first three contest days were anticyclonic with little or no cloud; their winners, flying Ka-7s, were: first, J. Friis (1957 Champion) and A. Jörgensen with 44 miles on an attempted race; and on the next two days N. Sejstrup and O. Didriksen, first to a 57-mile goal at 23.4 m.p.h., and then with 63 miles on an attempted 70-mile triangle. On the fourth day a few more clouds appeared and Dyhr Thomsen (1955 Champion) won a 68-mile out-and-return race at 29.3 m.p.h. in a Jaskolka ZO.

After two days of bad weather, performances jumped up and Harald Jensen (1953 Champion) averaged 59.4 m.p.h. on a 51-mile race to Aarhus with a Lo-150 lent him by Wolf Hirth. Two days' more bad weather, and then both leading Ka-7 two-seaters completed a 127-mile out-and-return, beating the previous national record of 96 miles. Svend Michaelsen nearly completed the course after being airborne for eight hours in his Mu-13d.

Only once before had anyone covered 200 km. (124 miles) in Denmark, but on the last day of this contest a 200-km. race was set and ten pilots completed it. Jensen was the winner at 30.4 m.p.h.

Leading total scores for the whole contest were: N. Sejstrup and O. Didriksen in a Ka-7, 5,435 points (out of 7,000 possible); J. Friis and A. Jörgensen in a Ka-7, 4,642; Svend Ravn in an L-Spatz, 4,548; Hans Borreby in an EoN Olympia, 4,212; H. Jensen in an Lo-150, 4,199. Of the other two former Champions, Dyhr Thomsen finished 9th and Aksel Feddersen 10th.

Lt.-Gen. Kurt Ramberg, C.-in-C. of R. Dan. A. F., in a K-7 piloted by K. V. Pedersen, gliding committee chairman of the Danish Aero Club.

"COMMANDER of Submarine Lands in Wharfedale!" was the headline in the Bradford *Telegraph & Argus* of August 17; however, it was not his submarine that Lieut. Cdr. M. P. Seth-Smith brought in to land by the Wharfe but his Skylark 2 sailplane in which he had left Camphill in Derbyshire 4¼ hours earlier in the hope of "returning to base" in Scotland.

Turning from the Navy to the Air Force we have the unprecedented total of 312 hours put up by the Wessex Gliding Club at R.A.F. Andover during the month of August. The gliders totalled nearly 1,900 miles across country, much of it in the last week-end, when, on the 29th, Frank Allen took the Eagle to Penzance.

B. B. Sharman (subsequent winner of the aerobatic contest), after spending the 30th retrieving Allen, made a Gold "C" flight on the 31st to Perranporth, after release from aero-tow over Lasham, in an Olympia 419. For the first 45 minutes Sharman found the thermals too narrow to do complete circles in; then he at last reached 3,000 ft., and covered 120 miles from Salisbury to Launceston in three hours; the whole flight took five hours. On the 30th Flt. Lt. Cretney made a Gold "C" and Diamond flight from R.A.F. Bicester to St. Mawgan.

The first Sunday of September brought heavy thunderstorms. The nearest one to Dunstable was in the airway, but, from Lasham, Ted Stark got up to 8,500 ft. and Nicholas Goodhart to 9,500 ft., while Philip Wills reached 12,500 ft. at about 16.00 hrs. and set out on a fast glide round a 100-km. triangle via Andover and Welford till he was down to 300 ft. above the Berkshire Downs. He recovered to 2,500 ft., from which Lasham was theoretically within gliding distance; but the thundery weather was, as usual, accompanied by large down-current areas and he landed half a mile short.

Correspondence

G.-W. and the Tabloid

FROM far off New Zealand, I would like to pay a tribute to the memory of the late Claude Grahame-White, whose obituary appeared in our New Zealand papers recently.

In the early days of aviation, it was my privilege to be often in contact with him, and I would like to pay tribute to his personal courage.

Many will remember his Tabloid Biplane and the really thrilling displays he gave of low flying during the circuit of Britain race, when it was necessary to do something to keep the vast crowd attending interested while waiting for competitors to arrive at Hendon.

This was but one example of the real physical courage, as well as the mental courage, which I always associated with him.

Auckland, N.Z. GEORGE F. JOSEPH.

Do not shoot the Pianist!

MR. D. W. LANCASTER, in your issue of September 25, "Sales Commentators?" page 271, suggests that the flying display commentator at Farnborough has a "fixed audience" which he should subject to two solid hours of sales talk. As commentator, and as one who has studied this matter rather more thoroughly than some people seem to realize, I believe that, under such an assault, the audience would soon unfix itself and become highly mobile. Farnborough is not the place for ad-mass plugs and idiot-lantern brain bashing. It would be less highly regarded by visitors if it were. I do little more than announce on the guest days, when people may wish to converse with a minimum of interruption, and I give a fairly full commentary upon the open days when the spectators' attention is concentrated upon the flying. That method has been developed not haphazard, but by sampling audience reactions.

Mr. Lancaster also proposes giving manufacturers' representatives the microphone. It is, I think, a good plan to make changes in the voice and this year I introduced three commentators other than myself; but they were not manufacturers' representatives. When I tried Mr. Lancaster's plan some years ago (do my critics never remember anything?) it failed. At my request, a Scottish commentator dealt with a Scottish aircraft, but hundreds of miserable Sassenachs telephoned to say that they could not understand a word he said. Other manufacturers' commentators aroused even more vigorous opposition, either because they were held to be overstating their case or because they "talked too much."

The commentator cannot please everybody. Sometimes I think that he cannot please anybody. All I ask is that before making suggestions, critics should try to understand the problem and inform themselves on the quite considerable work that has already been done in the attempt to solve it.

London, W.C.2. OLIVER STEWART.

More Than 200 Types in 8,000 Hours

YOUR correspondent, Mr. F. A. S. Brown (August 28 last) suggests I may hold the "championship" in the matter of "different types flown." Looking at the idea objectively, I think there is quite a chance that I have flown more different types of aircraft than anyone anywhere; if this is so, it is curious (and sad) to think that I shall hold that championship for ever because never again will there be large numbers of different types to fly, and few pilots will be qualified outside specific categories.

I had exceptional opportunities. In England, throughout World War I and for many years after, I was engaged in work where I was required, requested or permitted to fly almost anything flyable that I could get into, during a period where almost any new idea led to a new aircraft to try it out on. I came to this country in 1928 when Lindbergh's flight produced developments here which led to all sorts of new designs; again I had the kind of job where I had the chance to fly almost anything available. Some of the types I flew have been completely forgotten, some of them never flew more than once or twice. I could attempt a list if it would do anybody any good but it would take some time—every now and then I remember some obscure aircraft which I hadn't thought of for years.

I have no logbooks to help me much. When I returned here in 1940 I left my logbooks and other papers in a suitcase in an attic in Norfolk; on a trip home some years ago my wife found that they had been very thoroughly chewed up by mice. At a wild guess, I would say that I have flown somewhere between 200 and 300 different types—not including variations of the same type.

As to flying hours, I know that figure because I carried the numbers forward to the logbook I have; my total is something under 8,000 which doesn't seem much for some 45 years of flying. It is effectively even less than that because I put in a large number of hours during World War II on long ferry flights. However, "flying hours" as a measure of flying experience has long ceased to mean anything. For example, I have many entries of 18 to 20 hours for flights in which, in fact, I did little more than take-off and land; Mr. Sperry did the rest. On the other hand, as any test pilot knows, an unruly prototype on its first flight can give the pilot more real "flying" in 20 minutes than an airliner in 1,000 hours. In fact, it is almost fair to say that the piloting of a modern airliner involves all sorts of skills, but "flying" isn't one of them.

I would prefer not to comment on the tests, which Mr. Brown refers to, of the Koolhoven F.K.31. It is sufficient to say that "Kully" was, like many other designers, a champion optimist and he sometimes sincerely believed his aircraft to contain virtues which were really not there.

La Jolla, Calif., U.S.A. FRANK T. COURTNEY.

Wroundabout

Reciprocation is Bunk. An American engineer has stated that civil jet engines' wonderful reliability record is because they have "many more fewer parts than a piston engine." Or put it this way: With less movements for longer periods over shorter distances, more is reduced and a decrease is gained. This can do nothing but good.

*

Wround the World

Russia: Aeroflot are borrowing the B.O.A.C. film "Tomorrow is Theirs." Probably be one small change in that title.

Finland: Drunken Finnish car drivers are being sentenced to work one month on the Helsinki airport runway extension. A thirsty friend comments: "*Finnish*? I'd say it's the absolute *end*!"

Ireland: I can hardly bear to print the one about the Aer Lingus captain who said he was flying for Eire and reward.

Turkey: A recent reference here to the old jest about avoiding that Monday morning feeling by starting work on Tuesday has promoted a Canadian reader to recall that the high crash rate of the Turkish Air Force, about 20 years ago (when he was stationed there), seemed to be so clearly related to the week-end activities of its pilots that the order was actually issued: "No flying on Mondays."

Australia and Belgium: Perhaps the transparent plastic cowling over the Jindivik's Viper engine, along with the see-down windows in the wing-roots of the ultra-light Tipsy Nipper, will suggest a wider application to, say airliner designers. Transparent wings and fuel tanks, for instance, would let the pilot *see* if he's really got enough for that diversion against that headwind.

"Well, who are you going to believe—me or those crooked instruments?"

*

PRO and CON—4. Still they come, those dictionary definitions of P.R.O.-manship:

PROfession: A calling such as implies a measure of learning ("Not 'implies,' old boy—'*demands*!'").

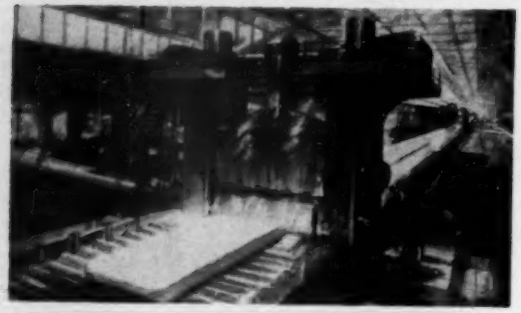
PROfuse: Lavish, extravagant, liberal to excess ("Really, you'd think it was the chief accountant's own money I was spending. . . .").

PROletariat: The poorest labouring class ("Actually, I can't *afford* an expense account.").

PROgnostic: Indicating something future by signs or symptoms ("Well, strictly off the record, Chris. . . .").

by Wrem

NOTES AND EVENTS



ALUMINIUM PRODUCTION. — An artist's impression of the new wide rolling mill now being installed at the Rogerstone works of Northern Aluminium Co., Ltd. When completed next year, it will enable the company to supply 10-ft.-wide aluminium plate.

ARALDITE GUIDE.—CIBA (A.R.L.), Ltd., of Duxford, has published a new guide to the materials which can be bonded by Araldite. Entitled "How to Use Araldite Epoxy Resin Adhesives," copies of the publication are available from the company at Duxford, Cambridge, on request.

WORLD DIRECTORY. — A 2nd edition of *The Oil Engine* World Directory of Manufacturers has been published by Temple Press Limited. Providing information as to the ranges of diesel powerplants in a convenient form, in English, French and German translations, it also includes a glossary of the technical terms used and an explanation of the basis upon which the entries have been made. The published price is 7s. 6d. net from all booksellers and bookstalls, or by post 7s. 11d. from Temple Press Limited, Bowling Green Lane, London, E.C.1.

CANADIAN SIMULATOR.—Redifon Ltd., in association with Redifon-Canada, has been awarded a contract to manufacture a flight simulator for the R.C.A.F. CC-106 transport. This is the R.C.A.F. version of the Canadair CL-44 transport. The contract is worth approximately $1 million.

AIR ELECTRONICS. — The first "maintenance meeting" of the European Airlines Electronics Committee was held in London on September 22 and 23. It was attended by radio and electronic representatives of Air France, Alitalia, D.L.H., Finnair, K.L.M., S.A.S., Sabena, Swissair, U.A.T., B.E.A. and B.O.A.C.

Personal Notices

BIRTHS

Alexander.—On September 22, at R.A.F. Hospital, Halton, to Pamela (*née* Boyd), wife of Sqn. Ldr. J. R. Alexander, D.F.C., D.F.M., R.A.F.—a daughter (Nicola Frances).

Clayton-Jones.—On September 22, in Blenheim, New Zealand, to Margaret (*née* Brady), wife of Flg. Off. R. Clayton-Jones, M.B., B.S., R.N.Z.A.F.—a son (Michael Anthony).

Hall.—On September 19, at R.A.F. Hospital, Wroughton, Wilts, to Isabel, wife of Flt. Lt. J. B. Hall—a son (Peter Craig).

Monge.—On September 20, at Crowtree Lane Hospital, Louth, to Joan, wife of Flt. Lt. F. R. Monge—a daughter (Louise Christina).

Sanderson.—On September 28, at Princess Mary's R.A.F. Hospital, Halton, to Barbara, wife of Wg. Cdr. D. S. Sanderson, R.A.F.—a son.

Thorpe.—On September 22, at R.A.F. Hospital, Ely, to Margaret (*née* Davenport), wife of Flg. Off. B. Thorpe, R.A.F.—a son.

Venier.—On September 22, at Imtarfa, Malta, to Betty, wife of Flt. Lt. A. L. Venier—a daughter (Julie Ann).

Vosloo.—On September 15, in Germany, to Penelope (*née* Ogden), wife of Flg. Off. A. L. Vosloo, R.A.F.—a son.

DEATH

Willcox.—On September 21, in a road accident, Plt. Off. H. Willcox, R.A.F.

Aviation Calendar

October 9.—Helic. Assn. of Gt. Britain lecture, "The Programme of Development Testing for a Helicopter," by T. G. G. Newbery, B.Sc.(Eng.), A.M.I.Mech.E., A.F.R.Ae.S. (Ministry of Supply), at the Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

October 13.—R.Ae.S. lecture, "Instruments and Flight Control Systems for Transport Aircraft," by W. H. McKinley, at Napier Senior Staff Canteen, **Luton Airport,** at 18.15 hrs.

October 14.—Society of Instrument Technology lecture, "An Automatic Analogue Computer for Missile Homing Investigations," by J. G. Thomason, B.Sc., A.Inst.P., A.M.I.E.E., at Manson House, 26 Portland Place, **London,** W.1, at 18.30 for 19.00 hrs.

October 14.—R.Ae.S. Brough Branch lecture, "Experiences of an Airline Pilot," by Capt. O. P. Jones, at the Royal Station Hotel Writing Room, **Hull,** at 19.30 hrs.

October 17.—R.Ae.S. Luton Branch, visit to the Shuttleworth Collection at **Old Warden.**

October 19.—R.Ae.S. Henlow Branch lecture, "Landing," by W. J. Charnley, in Building 62, The Technical College, **Henlow,** at 19.45 hrs.

October 21.—British Institution of Radio Engineers lecture, "Aviation Medicine," by P. V. Byford, at London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, **London,** W.C.1, at 18.30 hrs.

October 22.—University of London extra-mural studies lecture, "T/gram: Fair-weather Clouds," by Dr. R. S. Scorer, M.A., Ph.D., at the Kronfeld Club, Basement, 74 Eccleston Square, **London,** S.W.1.

October 22.—R.Ae.S. lecture, "Problems of Interplanetary Navigation," by T. R. F. Nonweiler, at Church House, Westminster, **London,** S.W.1, at 19.00 hrs.

October 22.—R.Ae.S. Isle of Wight Branch lecture, "Air Traffic Control and Jet Operations," by H. E. Smith, at the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, **E. Cowes,** at 18.00 hrs.

October 27.—Radar and Electronics Association lecture, "Electronics in Supersonic Flight," by F. W. Page, B.A., F.R.Ae.S., at the Royal Society of Arts, John Adam Street, Adelphi, **London,** W.C.2, at 19.30 hrs.

October 27.—Society of Instrument Technology lecture, "Modern Developments in Optical Instruments," by J. H. Bach, B.Sc., and G. E. Fisher, at Manson House, 26 Portland Place, **London,** W.1, at 19.00 hrs.

October 27.—R.Ae.S. Luton Branch debate, motion, "That this house considers that the craze for speed is technically unsound, economically undesirable and has taken all the romance and most of the interest out of travel," at the Napier Senior Staff Canteen, **Luton Airport,** at 18.15 hrs.

Company Notices

NEW COMPANIES

Mackley Services, Ltd. (636,518).—Private co. Reg. September 7. Cap. £1,000 in £1 shares. Objects: To provide services of any kind and to carry on the business of caterers, provision merchants and travel agents, etc. Subscribers (each with one share): John E. C. Macfarlane, Dowgate Hill House, E.C.4, solicitor; John M. Buckley, Dowgate Hill House, E.C.4, solicitor. Directors to be appointed by the subscribers. Sols.: Neish, Howell and Haldane, Dowgate Hill House, E.C.4.

Holiday Tokens, Ltd. (630,803).—Private co. Reg. September 10. Cap. £100 in 5s. shares. Holiday and travel promoters and agents, and to operate part or parts of the "S" plan devised by L. Castleton Knight. Directors: Leonard Castleton Knight, 43 Green Street, W.1; Hon. Sir George Bellew, The Dower House, Crimp Hill, Old Windsor; Sidney Wynne, 11 Grosvenor Court, Sloane Street, S.W.1 (director of Voice and Vision, Ltd.). Sec.: Benjamin J. Ketchlee. Reg. office: 9-12 Cheapside, E.C.2.

Trans Atlantic Air Coach, Ltd. (636,830).—Private co. Reg. September 10. Cap. £100 in £1 shares. To establish, maintain, work and carry on lines of aerial communications, etc. Directors: Cbone H. Dredzen, 3 Templeton Place, S.W.5; Ronald Myhill, Panton House, Haymarket, W.1; Thomas M. Wilson, Augustine B. Dromgoole. Sec.: R. Lobatto. Sols.: Barnett Janner and Co., W.C.1. Reg. office: 19 Grand Arcade, Trafalgar Square, W.C.2.

Kemp's Aerial Surveys, Ltd. (636,516).—Private co. Reg. September 7. Cap. £100 in £1 shares. To carry on the business of air and ground survey specialists, aerial photographers, etc. Directors: David C. Kemp, and Mrs. Elaine G. Kemp, both of Clock House, Curdridge, Hants. Sec.: Elaine G. Kemp. Reg. office: Friars Orchard, Curdridge, nr. Botley, Hants.

Aycliffe Construction, Ltd. (636,660).—Private co. Reg. September 8. Cap. £5,000 in £1 shares. To carry on the business of constructional, civil, mechanical, motor, aeronautical and electrical engineers. Subscribers (each with one share): John Pidgeon, Aciey House, Newton Aycliffe, Co. Durham, engineering consultant; Beryl C. Pidgeon, Aciey House, Newton Aycliffe, Co. Durham; G. H. Pidgeon, "Ammandale," Ankle Hill, Melton Mowbray, Leics, motor engineer. First director: John Pidgeon. Reg. office: Churchill House, Beveridge Way, Newton Aycliffe, Co. Durham.

OVERSEAS COMPANIES

Overseas Aviation (C.I.), Ltd. (F.4820).—Particulars filed September 3, 1959, pursuant to Section 407 of the Companies Act 1948. Cap. £5,000 in £1 shares. Reg. Jersey, Channel Islands, February, 1958. To carry on the business of aerial conveyancers of all kinds. British address: Panton House, Panton Street, Haymarket, S.W.1, where Paul de V. Stevens and Donald B. Ludbey are authorized to accept service of process and notices. Directors: Ronald Myhill, Taunus, Germany; Bernard A. Dromgoole, Frankfurt Main; Paul de V. Stevens, 143 Kings Road, Westcliff-on-Sea; Donald B. Ludbey, 26 Fountain Lane, Rockley, Essex. All directors of Overseas Aviation Engineering (G.B.), Ltd.

John Brown Land Boilers (Africa) (Proprietary), Ltd. (F.4823).—Particulars filed September 7, 1959, pursuant to Section 407 of the Companies Act 1948. Cap. £500,000 in £1 shares. Reg. in Union of South Africa in November, 1953, and to carry on the business of mechanical, electrical, civil, chemical, motor, aeronautical and general engineers. British address: 8 The Sanctuary, Westminster, S.W.1, where Alexander Grieve is authorized to accept service of process and notices. Directors: Eric Mensforth, 8 Stumperlowe Hall Road, Fulwood, Sheffield, 10; Vincent A. Pask, 73 Cornwall Road, Cheam, Surrey; William V. Wright, 1 Campbell Drive, Bearsden.

INCREASES OF CAPITAL

Crop Culture (Aerial), Ltd. (564,960).—Bembridge Airport, Isle of Wight. Increased by £20,000 in £1 shs. beyond the reg. cap. of £5,000.

E. H. Thompson and Son (London), Ltd. (388,276).—Manufacturers of scientific and aeronautical instruments, Skelton Works, 16 Chaucer Road, E.7. Increased by £5,000, in £1 ord. shs., beyond the reg. cap. of £5,000.

CHANGE OF NAME

P. N. D. Skingley (East Kent), Ltd. (509,765).—Air transport contractors, etc., Woolmer Hill House, Critchmere, Haslemere, Surrey. Name changed to Skingley (Flying Services), Ltd., on March 12, 1959.

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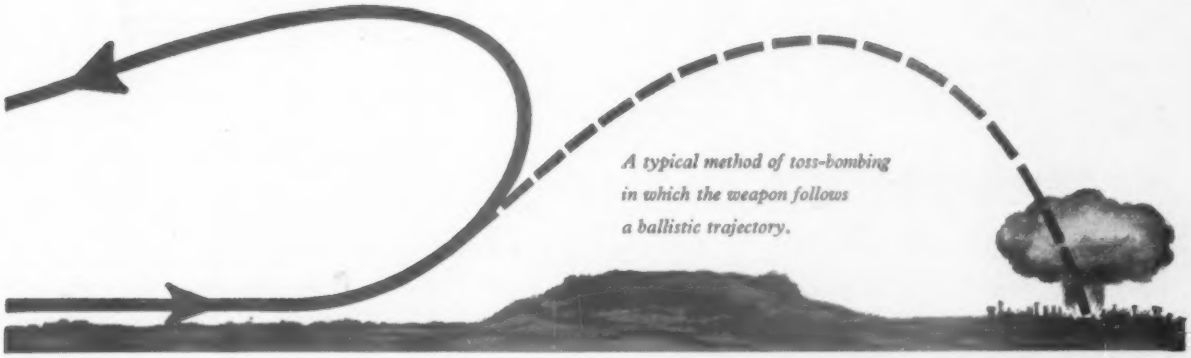

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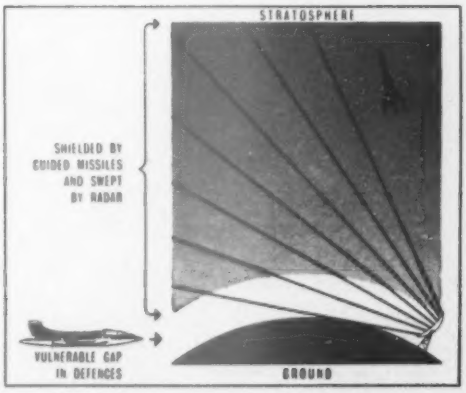

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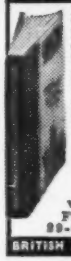

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NOTICES

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THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM THE BRITISH OVERSEAS AIRWAYS CORPORATION, OF LONDON AIRPORT, HOUNSLOW, MIDDX:—

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London-Luxembourg and/or Innsbruck (Application No. 373).

London-La Baule (Application No. 729).

London-Pisa (Application No. 1042).

London-Ostend (Application No. 1158).

London-Rimini (Application No. 1717).

Manchester and/or London-Perpignan (Application No. 3153).

Manchester and/or London-Zagreb (Application No. 3154).

Manchester and/or London-Malaga (Application No. 3155).

APPLICATION NO. 3152 (amended) for a U.K. Internal Service for the carriage of passengers, supplementary freight and mail, between London and Jersey at a frequency of one return flight weekly on Thursdays and two return flights weekly on Fridays, with Viking aircraft, together with one return flight weekly with DC6C aircraft or three return flights weekly with Viking aircraft, on Saturdays, from June 1 to September 30, 1960.

APPLICATION NO. 1042/4 for permission to operate each of the following services at an increased frequency of seven return flights weekly:—

APPLICATION No. 1042 approved with Viking, Viscount and DC6C aircraft on the route London Airport and/or London (Blackbushe)-Lyons (opt. tech.)-Pisa, at a frequency of four return flights weekly from March to October, each year, until October 31, 1964.

APPLICATION NO. 1717 approved with Viking, Viscount and DC6C aircraft, on the route London Airport and/or London (Blackbushe)-Lyons (opt. tech.)-Rimini or Forli at a frequency of two return flights weekly from April to October each year until October 31, 1964.

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APPLICATION NO. 780/1 for permission to operate with Ambassador and Bristol 170 aircraft in addition to the Viking and Dakota aircraft which they are at present authorized to operate on their Normal Scheduled Service between Southend and Lille at a frequency in accordance with traffic demand, until May 31, 1963.

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FROM STARWAYS, LTD., OF LIVERPOOL AIRPORT, 24:—

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APPLICATION NO. 3236 for a seasonal service on the route Liverpool-Nantes (opt. tech)-Palma at an initial frequency of one return flight weekly increasing later to four return flights weekly from May to October each year.

APPLICATION NO. 3237 for a seasonal service between Glasgow and Palma at an initial frequency of one return flight weekly increasing later to four return flights weekly from May to October each year.

(b) APPLICATION NO. 3240 for permission to carry members of Her Majesty's Forces on the undermentioned U.K. Internal Services at single fares not less than the British Railways' 2nd Class fares applicable between the departure and destination points, taking into account any rebate allowed by British Railways to Forces personnel:—

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Continued from previous classified column

APPLICATION NO. 3238 for a U.K. Internal Service between Coventry and Glasgow (Prestwick) at an initial frequency of one return flight weekly increasing later to three return flights weekly.

APPLICATION NO. 3239 for a seasonal Normal Scheduled Service, between Coventry and Biarritz, at an initial frequency of two return flights weekly increasing later to three return flights weekly, from May 1 to October 30 each year.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 503-6

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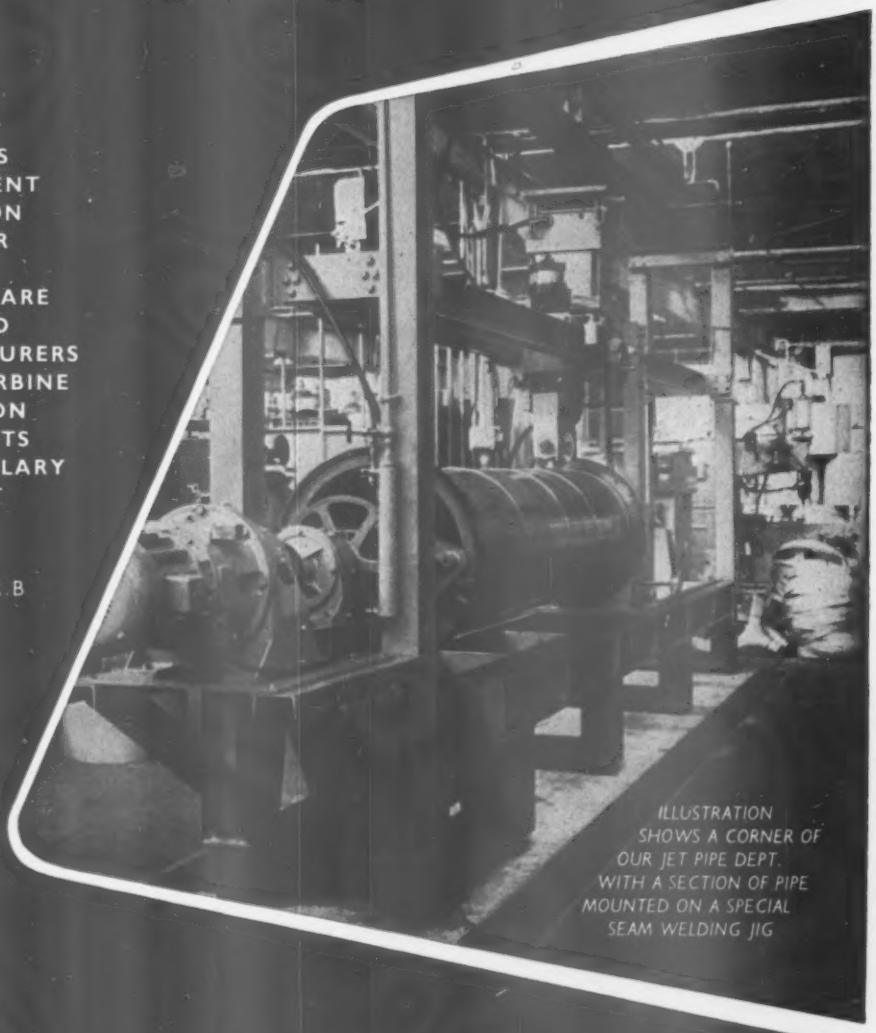

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